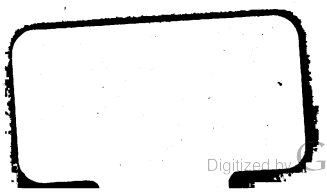

Colonial Museum and Geological Survey Department.

HANDBOOK

OF

NEW ZEALAND

WITH MAPS AND PLATES

[FOURTH EDITION, REVISED].

BY

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New Zealand -

PREFACE.

This Handbook was first published in accordance with a resolution of the Royal Commissioners appointed by His Excellency the Governor of the Colony to carry out and devise the proper representation of New Zealand at the Sydney Exhibition of 1879; a second edition was published for distribution at the Melbourne Exhibition of 1882; a third edition was prepared by direction of the Hon. Thomas Dick, Colonial Secretary, and the present edition has been issued by direction of the Colonial Treasurer, the Hon. Sir Julius Vogel, K.C.M.G.

The published literature bearing on New Zealand is very extensive. About eighty separate works have been quoted as published prior to the foundation of the colony in 1839, in which year the first number of the New Zealand Government *Gazette* was issued. Since that date the number of separate publications amounts to many hundreds, while the Parliamentary papers, both of the Provincial and General Governments, and the "Transactions of the New Zealand Institute," abound in valuable reports and memoirs that describe the history and resources of the country. Most of these works can, no doubt, be referred to at the great public libraries, and, to some extent, at the office of the Agent-General in London. Such research is, however, beyond the reach of most readers, and from the rapid disposal of former editions of this publication it is reasonable to infer that there is a demand for information of the kind now offered.

In the original preparation of this Handbook several previous works of a similar nature were largely drawn from, among which may be mentioned in particular the Jurors' Reports and Awards of the New Zealand Exhibition, 1865 (Dunedin, 1866); the admirable and exhaustive "Handbook of New Zealand" published by Sir Julius Vogel, K.C.M.G. (London, 1875); and the Official Reports on the New Zealand Court in the Philadelphia Exhibition, 1876, by the writer (London, 1877). The records of the various Government departments have been also largely made use of, particularly the annual volumes of statistics issued by Mr. W. R. E. Brown, Registrar-General. I must also acknowledge the valuable services of my assistants, Mr. Bryce Bain, Mr. S. Herbert Cox, F.G.S., and Mr. A. T. Bothamley.

In elaborating the details and revising the press of the present edition I have been ably assisted by Mr. W. E. Vaux.

JAMES HECTOR.

Colonial Museum,
Wellington, 1st January, 1886.

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HANDBOOK OF NEW ZEALAND.

GENERAL DESCRIPTION.

Situation and Area.

The Colony of New Zealand consists of two islands called the North and South Islands, and a small island at the southern extremity called Stewart Island. There are also several small islets, such as the Chatham and Auckland Isles, that are dependencies of the colony. The entire group lies between 34° and 48° S. lat. and 166° and 179° E. long. The two principal islands, with Stewart Island, extend in length 1,100 miles, but their breadth is extremely variable, ranging from 46 miles to 250 miles, the average being about 140 miles, but no part is anywhere more distant than 75 miles from the coast.

Area of the Islands.

	Sq. Miles.	Acres.
The total area of New Zealand is about ..	100,000	or 64,000,000
,, ,, the North Island being ..	44,000	,, 28,160,000
,, ,, the South Island being ..	55,000	,, 35,200,000
,, ,, Steward Island being ..	1,000	,, 640,000

It will thus be seen that the total area of New Zealand is somewhat less than that of Great Britain and Ireland. The North and South Islands are separated by a strait only thirteen miles across at the narrowest part, presenting a feature of the greatest importance from its facilitating intercommunication between the different coasts without the necessity of sailing round the extremities of the colony.

The North Island was, up to the year 1876, divided into four provinces—viz., Auckland, Taranaki, Hawke's Bay, and Wellington. Taranaki and Hawke's Bay lie on the west and east coasts respectively, between the two more important provinces of Auckland on the north and Wellington on the south.

The South Island was divided into five provinces—viz., Nelson, Marlborough, Canterbury, Otago, and Westland (Southland was for a short time an independent province). Nelson and Marlborough are in the north, Canterbury in the centre, Otago in the south, and Westland to the west of Canterbury.

These provinces, however, in 1876 were divided into sixty-three counties—thirty-two in the North Island and thirty-one in the south Island—and provincial government ceased to exist.

Names of Counties.

In the North Island.—Mongonui, Hokianga, Bay of Islands, Whangarei, Hobson, Rodney, Waitemata, Eden, Manukau, Coromandel, Thames, Piako, Waikato, Waipa, Raglan, Kawhia, Taranaki, Patea, Tauranga, Whakatane, Cook, Wairoa, Hawke's Bay, Wanganui, West Taupo, East Taupo, Rangitikei, Manawatu, Waipawa, Hutt, Wairarapa West, and Wairarapa East.

In the South Island.—Sounds, Marlborough, Kaikoura, Waimea, Collingwood, Buller, Inangahua, Amuri, Cheviot, Grey, Ashley, Selwyn, Akaroa, Ashburton, Geraldine, Waimate, Westland, Waitaki, Waikouaiti, Maniototo, Vincent, Lake, Peninsula, Taieri, Bruce, Clutha, Tuapeka, Southland, Wallace, Fiord, and Stewart Island.

Mountains and Plains.

New Zealand is mountainous, with extensive plains, which in the South Island lie principally on the eastern side of the mountain-range, while in the North Island the most extensive lowlands lie on the western side. In the North Island the interior mountainous parts are covered with dense forest or low shrubby vegetation; while in the South Island these parts are chiefly open and well grassed, and are used for pastoral purposes.

In the North Island the mountains occupy one-tenth of the surface, and do not exceed from 1,500 to 4,000 feet in height, with the exception of a few volcanic mountains that are more lofty, one of which, Tongariro (6,500ft.), is still occasionally active. Ruapehu (9,100ft.) and Mount Egmont (8,300ft.), are extinct volcanoes that reach above the limit of perpetual snow: the latter is surrounded by one of the most extensive and fertile districts in New Zealand.

The mountain-range in the South Island, known as the Southern Alps, is crossed at intervals by low passes, but its summits reach a height of from 10,000 to 12,000 feet, and it has extensive snow-fields and glaciers. Flanking this mountain-range and occupying its greater valleys are extensive areas of arable land, which are successfully cultivated from the sea-level to an altitude of over 2,000ft.

HISTORY.

First Settlement by Maoris.

New Zealand appears to have been first discovered and first peopled by the Maori race, a remnant of which still inhabits parts of the Islands. At what time the discovery was made, or from what place the discoverers came, are matters which are lost in the obscurity which envelopes the history of a people without letters. Little more can now be gathered from their traditions than that they were immigrants, and that when they came there were probably no other inhabitants of the country. Similarity of language indicates a Polynesian origin, which would prove that they advanced to New Zealand through various groups of the Pacific islands, in which they left remains of the same race, who to this day speak the same or nearly the same tongue. When Cook first visited New Zealand he availed himself of the assistance of a native from Tahiti, whose language proved to be almost identical with that of the New Zealanders, and through the medium of whose interpretation a large amount of the early information respecting the country and its inhabitants was obtained.

Discovery by Tasman.

The first European who made the existence of New Zealand known to the civilized world, and who gave it the name it bears, was Tasman, the Dutch navigator, who visited it in 1642. Claims to earlier discovery by other European explorers have been raised, but they are unsupported by any sufficient evidence. Tasman did not land on any part of the Islands, in consequence of having had a boat's crew cut off by the Natives in the bay now known as Massacre Bay, but contented himself by sailing along the western coast of the North Island, and quitted its shores without taking possession of the country in the name of the Government he served.

Visited by Captain Cook.

From the date of Tasman's flying visit to 1769 no stranger is known to have visited the Islands. In the latter year Captain Cook reached them in the course of the first of those voyages of great enterprise which have made his name illustrious.

The first of Cook's voyages of discovery began in August, 1768, when he was sent to Tahiti to observe a transit of Venus. After a run of eighty-six days from Tahiti, having touched at some other places,

he sighted the coast of New Zealand on the 6th of October, 1769. On the 8th he landed in Poverty Bay, on the east coast of the North Island, which is therefore held to be the date of the first occupation of the country.

THE NATIVE RACE.

Origin and Traditional History.

There is nothing on record respecting the origin of the Maori people; but their arrival in New Zealand, according to tradition, is due to an event which, from its physical possibility, and from the concurrent testimony of the various tribes, is probably true in its main facts.

The tradition runs that generations ago a large migration took place from a distant island, to which the Maoris give the name of Hawaiki. Quarrels among the Natives drove from Hawaiki a chief, whose canoe arrived upon the shore of the North Island of New Zealand. Returning to his home with a flattering description of the country he had discovered, this chief, it is said, set on foot a scheme of emigration, whereupon a fleet of large double canoes started for the new land. The names of most of the canoes are still remembered, and each tribe agrees in its account of the doings of the people of the principal "canoes" after their arrival in New Zealand; and from these traditional accounts the descent of the numerous tribes has been traced. Calculations, based on the genealogical staves kept by the *tohungas*, or priests, indicate that about twenty-seven generations have passed since the migration, which would give for its date about the beginning of the fourteenth century. The position of Hawaiki is not known, but there are several islands of this or a somewhat similar name.

Increase or Decrease.

As much difference of opinion has existed as to whether the numerical decline of the Maori race has not been, at any rate in certain districts, arrested, it may be interesting to compare, so far as they are given, the ages of the Maoris with the ages of the settled and steadily increasing population of England. The results of such inquiries show that there are causes in operation which increase the mortality of the adult Maoris without increasing the mortality of the children, so that the actual proportion of children to the whole population would be thereby much greater, and an appearance of productiveness shown which did not really exist.

Do such causes exist? Does the fact of the partial adoption by the adult Maori of civilized habits and costume, and the continual reversion to the habits and costume of barbarism, with a system rendered more susceptible to external influences, especially those of a humid and changeable climate, tend to promote the spread of disease, notably of tubercular diseases, and consequent mortality? Does the spread of drinking habits tend to shorten the life of the adult Maori? These and other similar questions have an important bearing on the subject.

Native Population, North Island.

The North Island is now supposed to contain a Native population of about 42,000, divided into many tribes; but their number is probably very largely over-estimated.

The most important tribe is that of the Ngapuhi, who inhabit the northern portion of the North Island, in the Provincial District of Auckland. It was among the Ngapuhi that the seeds of Christianity and of civilization were first sown, and among them are found the best evidences of the progress which the Maori can make. Forty-five years ago the only town in New Zealand, Kororareka, in the Bay of Islands, existed within their territory. Their chiefs, assembled in February, 1840, near the Waitangi ("Weeping Water") Falls, were the first to sign the treaty by which the Maoris acknowledged themselves to be subjects of Her Majesty; and, although under the leadership of an ambitious chief, Honi Heke, a portion of them in 1845 disputed the English supremacy, yet after being subdued by English troops and their Native allies (the Ngapuhi's own kinsmen) they adhered implicitly to the pledges they gave, and since then not a shadow of doubt has been cast on the fidelity of the "loyal Ngapuhi."

Native Population, South Island.

The South Island Natives number but about 2,000, and they are spread over an immense tract of country, living in groups of a few families on the reserves made for them when the lands were purchased; for the whole of the South Island has been bought from the Native owners by the Government. Whatever may be the cause, it is a fact that the Natives of the South Island are less restless and excitable than their brethren in the North.

Physical Character.

As a rule the Maoris are middle-sized and well formed, the average height of the men being 5 feet 6 inches; the bodies and arms are longer than those of the average Englishman, but the leg-bones

are shorter, and the calves largely developed. In bodily powers the Englishman has the advantage. As a carrier of heavy burdens the Native is the superior, but in exercises of strength and endurance the average Englishman surpasses the average Maori.

GOVERNMENT.

The colony was formerly divided into nine Provinces, each of which had an elective Superintendent, and a Provincial Council, also elective. In each case the election was for four years, but a dissolution of the Provincial Council by the Governor could take place at any time, necessitating a fresh election both of the Council and of the Superintendent. The Superintendent was chosen by the electors of the whole province; the members of the Provincial Council by those of electoral districts.

As has been already mentioned, this form of Government was abolished in 1876, and the country was then divided into Counties and Road Board Districts; and to the County Councils and Municipalities the local administration formerly executed by the Provincial Governments is confided. The seat of Government was at Auckland up to the year 1865, when it was transferred to Wellington on account of the more central position of the latter place.

Form of Government.

Executive power is vested in a Governor appointed by the Queen, who acts in accordance with the principles of Responsible Government. Legislative power is vested in the Governor and two Chambers; one called the Legislative Council, consisting at present of fifty-four members, nominated by the Governor for life; and the other the House of Representatives, elected by the people from time to time, and now consisting of ninety-four members. Until 1882 the House of Representatives was elected for five years, but by an Act passed in 1879 its normal term of service is now limited to a period of three years, which, however, may be shortened if the Governor should see fit to exercise his prerogative of dissolving it.

Except in matters of purely Imperial concern, the Governor, as a rule, acts on the advice of his Ministers. He has power to dismiss them and appoint others, but the ultimate control rests with the representatives of the people, who hold the strings of the public purse.

Electoral and Administrative.

Any man of twenty-one years and upwards, who is a born or naturalized British subject, and who has held for six months a free-

hold of the clear value of £25, or who has resided for one year in the colony, and in an electoral district during the six months immediately preceding the registration of his vote, is now, according to an Act passed in 1879, entitled to be registered as an elector and to vote for the election of a member of the House of Representatives; also, every male Maori of the same age whose name is enrolled upon a ratepayers' roll, or who has a freehold estate of the clear value of £25. And, by another Act passed on the same day, the duty is imposed upon the Registrar of each electoral district of placing on the electoral roll the names of all persons who are qualified to vote. Any person qualified to vote for the election of a member of the House of Representatives is also, generally speaking, qualified to be himself elected a member of that House. There are, however, certain special disqualifications for membership, such as grave crime, bankruptcy, and paid office (other than what is called political) in the colonial service. Four of the members of the House are Maoris, elected under a special law by Maoris alone.

The Colonial Legislature, which as a rule meets once a year, has power generally to make laws for the peace, order, and good government of New Zealand. The Acts passed by it are subject to disallowance by the Queen, and in a very few cases are required to be reserved for the signification of the pleasure of Her Majesty, but there have not been, in the course of the twenty-seven years since the Constitution was granted, more than half a dozen instances of disallowance or refusal of assent. The Legislature has also, with a few exceptions, ample power to modify the Constitution of the colony. Executive power is administered, as before stated, in accordance with the usage of Responsible Government as it exists in the United Kingdom.

Legislation concerning the sale and disposal of Crown lands, and the occupation of the goldfields, is exclusively vested in the Colonial Parliament.

There are in most towns in the colony municipal bodies, such as Mayors and Town Councils in England, invested with ample powers for sanitary and other municipal purposes; and there are in various country districts elective Road Boards charged with the construction and repair of roads and bridges, and with other local matters. There are also Central and Local Boards of Health appointed under a Public Health Act, which have authority to act vigorously, both in towns and in the country, for the prevention and suppression of dangerous and infectious diseases.

The above short summary of the system of Government in New Zealand suffices to show that the leading characteristics of the British

Constitution—self-government and localized self-administration—are preserved and, in fact, extended under the New Zealand Constitution; that there is ample power to regulate its institutions, and to adapt them from time to time to the growth and progress of the colony, and to its varied requirements; and that it is the privilege of every colonist to take a personal part to some extent, either as elector or elected, in the conduct of public affairs and in the promotion of the welfare of the community.

VEGETABLE AND ANIMAL PRODUCTS.

Vegetation.

The indigenous forest of New Zealand is evergreen, and contains a large variety of valuable woods. Amongst the smaller plants the *Phormium tenax*, or New Zealand flax, is of special value; whilst large tracts of country are covered with nutritious indigenous grasses, which support millions of sheep, and have thus been productive of great wealth to the colony. Many of the more valuable trees of Europe, America, and Australia have been introduced, and now flourish with a vigour scarcely ever attained in their natural habitats. In many parts of the colony the hop grows with unexampled luxuriance; whilst all the European grasses and other useful plants produce returns equal to those of the most favoured localities at Home. Fruit, too, is abundant all over New Zealand. Even in the latitude of Wellington oranges, lemons, citrons, and loquats are found, whilst peaches, pears, grapes, apricots, figs, melons, and, indeed, all the ordinary fruits of temperate climates abound. Roots and vegetables of all kinds grow luxuriantly.

Timber and Forest-trees.

The general character of the New Zealand woods resembles the growths of Tasmania and the Continent of Australia, most of them being harder, heavier, and more difficult to work than the majority of European and North American timbers. They vary, however, very much among themselves. Many varieties are very durable, and Manuka, Totara, Kauri, Black-birch, Kowhai, and Matai appear to be the most highly esteemed on the whole.

Strength of New Zealand Timbers.

The following table gives the results of experiments, extending over a period of some years, on the strength of the principal timbers of the colony:—

RESULTS OF EXPERIMENTS ON NEW ZEALAND TIMBERS.
[The dimensions of the specimens were 1 inch square and 12 inches long.]

No.	Native Names in Alphabetical Order.	Specific Gravity.	Weight of a Cubic Foot.	Greatest Weight carried with Unimpaired Elasticity.	Transverse Strength.
			lb.	lb.	lb.
1	Hinau, or Pokaka (*Elæocarpus dentatus*)	·562	33·03	94·0	125·0
2	Kahika, supposed white-pine	·502	31·28	57·3	77·5
3	Kahikatea, white-pine (*Podocarpus dacrydioides*)	·488	30·43	57·9	106·0
4	Kauri (*Dammara australis*)	·623	38·96	97·0	165·5
5	Kawaka (*Libocedrus doniana*) ..	·637	39·69	75·0	120·0
6	Kohekohe (*Dysoxylum spectabile*) ..	·678	42·25	92·0	117·4
7	Kowhai (*Sophora tetraptera* var. *grandiflora*)	·884	55·11	98·0	207·5
8	Maire, black maire (*Olea cunninghamii* ..	1·159	72·29	193·0	314·2
9	Maire-tawhake (*Eugenia maire*) ..	·790	49·24	106·0	179·7
10	Mako (*Aristotelia racemosa*)	·593	33·62	62·0	122·0
11	Manoao (*Dacrydium colensoi*) ..	·788	49·10	200·0	230·0
12	Mangi, or mangeao (*Tetranthera calicaris*)	·621	38·70	109·0	137·8
13	Manuka (*Leptospermum ericoides*) ..	·943	59·00	115·0	239·0
14	Mapau, red mapau, or red-birch (*Myrsine urvillei*)	·991	61·82	92·0	192·4
15	Matipo-tarata (*Pittosporum tenuifolium*)	·955	60·14	125·0	243·0
16	Matai (*Podocarpus spicata*)	·787	49·07	133·0	197·2
17	Miro (*Podocarpus ferruginea*) ..	·658	40·79	108·0	190·0
18	Puriri (*Vitex littoralis*)	·959	59·50	175·0	223·0
19	Rata, ironwood (*Metrosideros lucida*) ..	1·045	65·13	93·0	196·0
20	Rewarewa (*Knightia excelsa*)	·785	48·92	93·0	161·0
21	Rimu, red pine (*Dacrydium cupressinum*)	·563	36·94	92·8	140·2
22	Taraire (*Nesodaphne taraire*)	·888	55·34	99·6	112·3
23	Tawa (*Nesodaphne tawa*)	·761	47·45	142·4	205·5
24	Tawiri-kohukohu, white mapau (*Carpodotus serratus*)	·822	51·24	80·0	177·6
25	Titoki (*Alectryon excelsum*)	·916	57·10	116·0	248·0
26	Totara (*Podocarpus totara*)	·559	35·17	77·0	133·6
27	Tawai, red-birch (*Fagus menziesii*) ..	·626	38·99	73·6	158·2
28	Tawai, black-birch (*Fagus fusca*) ..	·780	48·62	108·8	202·5
29	Whawhako (see also Maire) (*Eugenia maire*)	·637	39·63	75·0	120·0
30	Whau (*Entelea arborescens*)	·187	11·76	13·0	32·0

The experiments were conducted in the following manner: A pressure of 50lb. was applied for two minutes (as measured by a sand-glass), and the sample was then released; 75lb. was then applied for the same time, and then 100lb., and so on, increasing by 25lb. each time. Each time the sample was released the point on the deflection scale to which it returned was read, and when it came to be notably under the original reading it was allowed to remain unloaded for two minutes, to see whether it would in time recover itself. Then the pressure was gradually increased, without being removed, until the specimen broke.

A particular description of forty-four of the principal forest-trees will be found in the appendix.

Extent of Forest Land.

The estimated proportion of forest land in each provincial district is as under:—

	Percentage of Forest Land.
North Island—	
Auckland	9·449
Hawke's Bay	11·803
Taranaki	88·013
Wellington	57·142
South Island—	
Nelson	14·434
Marlborough	19·301
Canterbury	4·306
Westland	62·809
Otago ... ... }	8·729.
Southland ... ... }	

Further particulars will be found in the table relating to the Crown lands of the colony, shown on the table of statistics attached to this book.

The value of the export trade in timber for the decade 1868–77 amounted to £333,083, increasing from £15,653 in the former year to £50,901 in 1877. The trade is now rapidly growing, and in 1884 the total export was £152,932, of which £129,367 was for sawn timber.

Bark for Tanning and Dyeing.

A number of the native forest trees and plants furnish good dyes from their bark. The Natives were acquainted with most of these, and dyed their flax mats and baskets with them.

A black dye can be made from the bark of the hinau (*Elæocarpus dentatus*), and by adding a rust of iron an excellent non-corrosive ink is obtained.

Brown and red dyes are obtained from the bark of the towhai or tawhero *(Weinmannia racemosa)*. The Native mode of procedure is first to bruise the bark, and boil it for a short time along with the flax to be dyed, which, when the infusion is cold, is taken out and steeped thoroughly in red swamp-mud, rich in peroxide of iron; it is then removed and dried in the sun.

The towhai is a forest-tree abundant in many parts of New Zealand. The bark has been successfully used as a tanning agent. The dye obtained from this bark gives a very fast class of shades

upon cotton; it can be sold at the same price as gambier and catechu. The extract is more astringent than that of the hinau, and needs only to be introduced to be accepted by tanners.

The bark of the tanekaha *(Phyllocladus trichomanoides)* is now exported to a small extent as a dye-stuff that imparts fine shades to fancy leathers for glove-making.

Tan-barks Native to New Zealand.

Name.	Native Name.	Percentage of Tannin.
Bark of Phyllocladus trichomanoides	Tanekaha ..	23·2
Bark of Elæocarpus dentatus..	Hinau	21·8
Bark of Metrosideros robusta..	Rata	18·6
Bark of Coriaria ruscifolia	Tutu	16·8
Bark of Eugenia maire	Whawhako ..	16·7
Bark of Weinmannia racemosa	Tawhero	12·7
Bark of Elæocarpus hookerianus	Pokaka	9·8
Wood of Fuchsia excorticata..	Kotutuku ..	5·3
Bark of Knightia excelsa	Rewarewa ..	2·7
Bark of Myrsine urvillei	Mapau	1·4

Phormium Tenax (the New Zealand Hemp).

The history of what is termed the flax industry in New Zealand affords a remarkable instance of the difficulty experienced in developing the natural resources of a country if the commodities to be disposed of have not a previously-established market value.

When the colonists first arrived in New Zealand the valuable qualities of the Phormium fibre were well known, as it was in constant use by the Natives, and a very considerable trade in the article existed as early as 1828, when the Islands were only visited by whalers and Sydney traders, fifty thousand pounds' worth of the fibre being sold in Sydney alone between 1828 and 1832. At Grimsby, in Lincolnshire, a manufactory was also established in the latter year for the production of articles from the New Zealand fibre, which failed from some unexplained cause, notwithstanding that the results were not considered at the time unsatisfactory. From 1853 to 1860 the average annual value of the fibre exported was nearly £2,500, reaching as high as £5,000 in 1855; but up to that time the only fibre exported was that prepared by Native labour, no machinery of any kind being employed in producing the exported article. In 1860, therefore, when the Native disturbances affected the Waikato and other interior districts in the North Island, the preparation was confined to the Native tribes north of Auckland, so that the average export value was only £150 per annum. Attention was then directed towards the contrivance of machinery with the aid of which the fibre could be

profitably extracted by European labour. In 1861 the increasing demand for white rope, and the limited quantity of manilla (which fibre depends for its production on native manual labour in the Phillipine Islands), led to a rise in its value from £21 to £56 per ton, and even to £76 per ton in America during the late civil war. These high prices stimulated the endeavour to introduce Phormium fibre to compete with manilla, and several machines were invented for rapidly producing the fibre from the green leaf. With these machines the export trade again increased, so that from 1866 to 1871 the yearly average was valued at £56,000. This sudden revival of the trade led many to embark in it who were not only unacquainted with the new form of manufacture, but also unaccustomed to any kind of business that required special mechanical skill and careful elaboration of the details of management.

Commissioners were appointed in 1869 and 1870 to investigate and report on the manufacture and cultivation of the plant and the particular requirements of the market.

Recently the term "flax" has been changed to "hemp," with great advantage to the position which the fibre holds in the brokers' sale-rooms; but the fibre can be prepared so as to mix advantageously with true *Linum* flax in the manufacture of textile fabrics, and the shortness of the ultimate fibre is not an insuperable obstacle even to its being spun into unmixed yarns. It will, therefore, in all probability, be necessary to adopt two names for the fibre to indicate the purpose for which it has been specially prepared, such, for instance, as Phormium hemp and Phormium flax. Samples of serge-sheeting, canvas-sacking, and other varieties of cloth from unmixed Phormium fibre, have been manufactured in Scotland and sent out to the colony, and also samples of a very superior kind of canvas made from an admixture of Phormium with Riga flax. The fibre used in these experimental manufactures was prepared by Mr. C. Thorne by the use of alkaline solutions, and it is stated that such fibre would find a ready market in large quantities at from £60 to £90 per ton. Whether this would be as profitable an application of the fibre as the production of hemp is, however, not yet established.

It is a matter of considerable interest that the coarser descriptions of Phormium hemp are again in demand for the purpose of manufacturing the stiff harsh twine that is best adapted for the self-binding reaping-machines.

The total quantity of Phormium exported between the years 1864 and 1876 amounted to 26,434 tons, valued at £592,218. The quan-

tity exported in 1878 amounted to 622½ tons, valued at £10,666; in 1881 to 1,307 tons 15cwt., valued at £26,285, and in 1884 to 1,624 tons, valued at £24,500.

AGRICULTURE.

Allusion has been made to the area of country occupied by mountain-ranges in New Zealand, and the general position they occupy with reference to the geography of the country: it may be further stated that, with the exception of the higher alps, every part of the country is more or less adapted for settlement of some kind. A clearer idea of the value of the country and the purposes to which it is applicable is, however, obtained by the comparison of the rock-formations the decomposition of which produces the soils, as shown in the following table. From a study of this table it will be found that in the whole of the colony there are about 12,000,000 acres of land fitted for agriculture, wherever the form of surface is suitable, and about 50,000,000 which are better adapted for pasturage; but from these estimates allowance must be made for about 20,000,000 acres of surface at present covered by forest.

Classification of Geological Subsoil.

The following table gives a classification of the lands according to the geological subsoil:—

——	North Island.	South Island.	Totals.
	Sq. miles.	Sq. miles.	Sq. miles.
1. Fluviatile drifts, one third agricultural	8,447	6,286	14,733
2. Marine Tertiary, two-thirds agricultural (rest pastoral)	13,898	4,201	18,099
3. Upper Secondary, coal-bearing, pastoral	2,390	2,110	4,500
4. Palæozoic, pastoral	5,437	20,231	25,668
5. Schistose, pastoral	..	15,308	15,308
6. Granite, worthless	..	5,978	5,978
7. Volcanic, one-sixth agricultural (rest pastoral) ..	14,564	1,150	15,714
	44,736	55,264	100,000

Varieties of Soil.

It would be beyond the scope of this description to give in detail the endless varieties of soil which are found in New Zealand, but attention may be drawn to the chief peculiarities.

Northern District.

In the north of Auckland, including the lower portion of the Waikato Valley, light basic volcanic soils prevail, interspersed with areas of clay-marl, which in the natural state is cold and uninviting to the agriculturist, but which, under proper drainage and cultivation, can be brought to a high state of productiveness. The latter soils, however, are generally neglected at the present time by the settlers, who prefer the more easily worked and more rapidly remunerative soils derived from the volcanic rocks.

North-western District.

In this district, which extends round to Taranaki and Wanganui, the soil is all that can be desired, and is probably one of the richest areas in the Southern Hemisphere. The surface soil is formed by the decomposition of calcareous marls, which underlie the whole country, intermixed with *débris* from the lava-streams and tufaceous rocks of the extinct volcanic mountains. The noble character of the forest which generally covers the area proves the productiveness of its soil, although at the same time it greatly impedes the progress of settlement.

North-eastern District.

In this district of the North Island, from Taupo towards the Bay of Plenty, the surface soil is derived from rocks of a highly siliceous character, and large areas are covered with little else than loose friable pumice-stone. Towards the coast, and in some limited areas near the larger valleys, such as the Waikato and the Thames, and also where volcanic rocks of a less arid description appear at the surface, great fertility prevails, and any deficiencies in the character of the soil are amply compensated for by the magnificence of the climate of this part of New Zealand. On the eastern side of the slate range which extends through the North Island the surface of the country is generally formed of clay-marl and calcareous rocks, the valleys being occupied by shingle deposits derived from the slate and sandstone rocks of the back ranges, with occasional areas of fertile alluvium of considerable extent. It is only the latter portions of this district which can be considered as adapted for agriculture, while the remainder affords some of the finest pastoral land to be met with in any part of the colony.

South-eastern District.

In the South Island the chief agricultural areas are in the vicinity of the sea-coast, but there are also small areas in the interior, in the

vicinity of the lake districts, where agriculture can be profitably followed. The alluvial soils of the lower part of the Canterbury Plains, and of Nelson, Otago, and Southland, are the most remarkable for their fertility; but scarcely less important are the low rolling downs formed by the calcareous rocks of the Tertiary formation, which skirt the higher mountain masses, and frequently have their quality improved by the disintegration of interspersed basaltic rocks.

South-western District.

On the western side of the South Island the rapid fall of the rivers carries the material derived from the mountain-ranges almost to the sea-coast, so that comparatively small areas are occupied by good alluvial soil; but these, favoured by the humidity of the climate, possess a remarkable degree of fertility.

Progress of Agriculture.

By the proper selection of soil, and with a system of agriculture modified to suit the great variety of climate which necessarily prevails in a country extending over 12 degrees of temperate latitude, every variety of cereal and root crop may be successfully raised in New Zealand; and, with due care in these respects, New Zealand will not fail to become a great producing and exporting country of all the chief food staples.

The progress made in agriculture has been very rapid, and the number of persons engaged in this pursuit is, as compared with other countries, very large, more than one in every five of the adult male population being in this way possessed of a permanent stake in the country. The number of holdings of one acre and upwards of cultivated land (exclusive of gardens attached to residences and Native holdings) enumerated in March, 1878, was 20,519, an increase of 1,769 on the year previous; in February, 1879, the number of holdings had increased to 21,048; in February, 1882, it had further increased to 26,298; and according to the returns collected in February and March, 1885, the number was 29,814. The exports of agricultural and farm produce (exclusive of wool) increased from £262,930 in 1875, to £1,114,253 in 1881, and £1,891,887 in 1884. In 1883, the exportation of wheat alone reached the value of £1,067,309; but since then, owing to the discouraging fall in prices, and the fact that the wheat growing was only a step in the process of laying down land in grass, the value of wheat exported decreased to £436,728 in 1885.

Average Yield of Crops.

The extent of land under wheat in the early part of 1882 was 365,715 acres, an increase on the area in wheat in 1881 of 40,766 acres. In February and March this area had decreased to 270,043 acres, doubtless owing to the low price of wheat in Europe. The aggregate produce of the wheat crop was estimated at 8,297,890 bushels in 1881, and at 6,886,777 bushels in 1885, the 1884 crop having been as high as 9,827,136 bushels. The estimated produce averaged 25·43 bushels in 1885 against 26·02 bushels per acre in 1884. The total area in oats in the whole colony, both for green food and for grain, was 426,028 acres in 1885, an increase of 80,054 as compared with the previous year. The crop amounted to 12,360,449 bushels in 1885, an average of 34·84 bushels to the acre, the figures for the previous year being 9,231,339 and 34·11. The area under barley increased from 32,907 acres in 1884 to 39,703 acres in 1885, and the crop from 964,456 to 1,205,906 bushels, the average being 30·37 in the latter and 29·31 in the former year. The land under hay fell off in 1884 and 1885 from 73,997 to 56,670 acres, and the produce from 102,649 tons to 79,868 tons, while the average per acre increased slightly, from 1·39 tons to 1·41. The cultivation of potatoes varied but little in these two years; the area increased from 21,104 to 21,348 acres, the crop from 113,198 to 123,504 tons, and the average yield per acre from 5·36 to 5·79 tons.

The total number of acres under crop, exclusive of land under grasses throughout the colony, was in 1885 1,335,130, a slight increase on that of the year before—namely, 1,322,246. Of this total only 106,661 acres (or not quite 8 per cent. of the whole) are in the North Island as against 1,223,469 acres in the South Island. The two Provincial Districts of Otago and Canterbury alone contain 1,188,259 acres, or 89 per cent of the total for the colony.

The number of acres under grasses, including grass-sown land not previously ploughed, amounted to 5,315,504 in 1885, which shows an advance compared with the returns of 1884 of 506,861. Of the total 2,781,893 acres are in the North and 2,533,611 in the South Island, each island in this case containing nearly the same share.

PASTORAL PURSUITS.

The mildness of the winter season (which does not require that any special provision for the keep of stock during that period should be made), the general suitability of the country for grazing purposes,

and the production of a superior class of wool, caused the attention of the first settlers to be much given to pastoral pursuits, so that at a very early date all grass lands were taken up as sheep or cattle runs. The success attending the pursuit enabled the runholders to a large extent to purchase the freehold of their runs, or the best portions of them; and by improvements in fencing and sowing with English grasses, which thrive remarkably well in the colony, the bearing capabilities of the land were increased many-fold. While in the North Island there are considerable tracts of grazing ground with natural herbage, a large extent of the country consists of hill land of varying quality, covered with forest, or bush, as it is called in the colony. This land, after the bush has been cut down and set fire to, if grass seed be sown upon the ashes, is converted in a few weeks into good grazing land. Much forest has already been destroyed in this manner, and the land supports large flocks and herds; and the same system will doubtless be extensively followed, as a large portion of country that would be so used is not available for agricultural pursuits. In the South Island the bush is chiefly confined to the western slopes of the dividing range; the open hills, plains, and downs to the east of the range being available for grazing purposes. The extent to which pastoral pursuits have been followed may be estimated by the quantity of stock in the colony in 1881 (when the census was last taken). The numbers of the undermentioned kinds were as follows:—

Horses	...	...	...	161,736
Cattle	...	...	...	698,637
Sheep	...	...	...	14,056,266*

These numbers do not include the animals in the possession of aboriginal natives, no estimate of which can be given; while, however, possessing a considerable number of horses, they own but small numbers of sheep and cattle.

The annual crop of wool has on the whole steadily increased since the first settlement of the colony in 1839. In 1881 there was a slight decrease, which is to be explained chiefly by the large increase of rabbits, and also to the consumption of nearly a million pounds of wool in the manufacture of woollen goods within the colony. The exports for the last twelve years ending respectively on the 30th September, or just before the shearing season begins, were as follow:—

* As returned by the Stock Branch of the Colonial Secretary's Department, on 31st May, 1884.

	lb.
1873	42,233,470
1874	47,424,882
1875	49,942,148
1876	55,975,177
1877	56,520,278
1878	62,166,251
1879	62,643,497
1880	62,586,189
1881	60,477,151
1882	65,356,867
1883	68,149,430
1884	81,139,028

While much of the country is only suited for sheep, a considerable portion is well adapted for the grazing of cattle. Much attention has been paid to, and capital expended on, the improvement of the various kinds of domestic animals; and some of the sheep and cattle fattened on grasses only may well bear comparison with the animals fattened on artificial food for the English markets.

The horses in the colony vary much in quality: for some years they realized such low prices that but little attention was paid to the breeding of good saddle-horses, and, as the Maoris possess large numbers of mares (not included in the census numbers), and breed from them without much regard to the improvement of stock, there has been a large increase in the number of small weedy animals. Where care has been taken excellent results have been obtained. As both draught-horses and thoroughbreds of the best strains of blood have been imported, first-class animals of either sort are obtainable, and always command a good value.

The various large agricultural shows periodically held in different parts of the colony, and heartily supported by farmers, stockowners, and the general public, have done much to encourage the good breeding of horses and cattle, and all other kinds of stock.

WOOL.

Wool is, undoubtedly, the most important production of New Zealand, its value in export being more than treble that of gold.

Wool is divided into two classes, combing wool and clothing wool; from which are produced the two leading kinds of manufacture in the cloth trade—viz., worsted and woollen goods.

The first comprises the long-stapled wools of the Lincoln, Leicester, Cotswold, and Romney Marsh breeds of English sheep.

They are required for worsted goods, and, when combed, for bombazines, camlet, &c. This is a class of wool for the production of which the soil and climate of New Zealand are very suitable. The long-woolled sheep of Great Britain improve by the change; the length of the wool is increased, and all its valuable properties preserved, owing doubtless to the genial climate and absence of exposure to the extremes of an English temperature.

The Leceister breed has received great attention in New Zealand, and is the favourite with the Auckland sheep-farmers.

The Cotswold is a wool very similar to the Leicester, but of a somewhat deeper and harsher character, and lacks the "lustre" so much in demand for certain classes of manufactured goods. The Cotswold appears quite as much in favour with the New Zealand breeder as the Leicester, and probably its habits and character are more generally adapted to the climate of the South Island and the mountain pastures of the colony than any other long-woolled sheep. The Cotswold bears exposure better than the Lincoln or Leicester, will live and thrive on poor land, and come to more weight of carcass than any other breed.

The value of this breed as a cross with either Leicester or short-woolled sheep cannot be too much spoken of, and the favour in which crosses with the Cotswold are held is a sufficient proof of their excellence.

The Romney Marsh partakes in a measure of the qualities of the Leicester and Lincoln, being a soft, rich, and good handling wool, rather finer in quality than the Leicester, and having the glossy or "lustre" appearance of the Lincoln. Wool of this description is much in demand for certain fabrics, and is much sought after in the French markets.

The Cheviot is a wool that has grown into considerable popularity of late years, and is largely used in the worsted manufacture. It is a small fine-haired wool, of medium length and moderate weight of fleece.

The varieties of fabrics manufactured from these long-stapled wools are almost innumerable, and are perpetually varying according to the changes of fashion, though there are certain fixed kinds which may be interesting to mention—viz., *Sayes*, which is used for clerical and academical vestments. *Serge*, *Sateens*, light woven cloths for ladies' dresses. *Reps* are heavier, and from the method of weaving have a transverse ribbed appearance. *Cords* are like the last, but with longi-

tudinal ribs. *Moreens,* watered cloths. *Merinoes,* finely-woven cloths, originally made from the fine Spanish wool called merino. *Paramattas,* fine cloths originally made from the Paramatta wool with silk warps, though now woollen. *Camlets,* thin plain-woven cloths. *Damasks, Shalloon,* and, when made with cotton warps, *Crapes, Coburgs, Tammies, Delaines, Lasting,* and *Orleans* cloths.

The second kind or clothing wool comprises the short-stapled wool grown by the Southdown and Shropshire Down breeds of English sheep, and the Merino (Spanish) sheep, fromwhich are manufactured woollen goods, including broadcloths and fancy kinds.

The Southdown is a short-stapled fine-haired close-growing wool, used chiefly for clothing purposes. The value of this breed to New Zealand sheep-farmers consists mainly in the improvements which crossing with it imparts to the carcass. Some breeders have crossed the Southdown with the Merino, and with cross-bred Romney Marsh and Merino.

The Shropshire Down is a breed which is growing every year into more importance. It produces a wool longer in the staple and more lustrous than any other Down breeds. It has been cultivated in New Zealand to a small extent only.

The Merino is the most valuable and important breed cultivated in New Zealand, and of sheep of this class the flocks of the colony are chiefly composed; they are of the Australian Merino variety, improved through the importation of pure Saxon Merino rams from Germany. The excellence of the Merino consists in the unexampled fineness and felting property of its wool, which in fineness and the number of serrations and curves exceeds that of any other sheep in the world. Fine Saxon Merino wool has 2,720 serrations to an inch, Merino wool 2,400, Southdown wool 2,000, and Leicester 1,850. These figures represent the felting properties of the various wools. The Merinoes adapt themselves to and thrive in every change of climate, and, with common care, retain all their fineness of wool as well under a burning tropical sun as in cold mountain regions.

In New Zealand the length of staple and weight of fleeces have been increased, without any deterioration in the quality of the wool.

Of the fabrics manufactured from these kinds of wool may be mentioned — *Doeskins,* technically called "seven-harness cloth." *Cassimeres* and *Kerseymeres* are "four-harness cloths," that is, four instead of seven threads in warp and weft, and in the kerseymeres the web, being subject to an extra milling, is rendered more compact. *Sataras,* ribbed cloths, highly dressed, lustred and hot-pressed. *Venetians,* woven as twills. *Meltons,* stout cloths not dressed or

finished except by paring. *Beavers, Deerskins, Diagonals,* or fancy cloths. *Bedford-cords,* usually drab-coloured ribbed cloths, of great strength and durability. *Tweeds,* which are lightly felted, originally of Scotch manufacture, but now largely produced in this colony of a quality and variety of pattern quite equal to any that can be imported.

Up to the present time the weaving industry in New Zealand has been confined to tweeds, plaiding, and blankets, and various woollen underclothing.

The value of wool exported in 1884 amounted to £3,267,527.

ANIMAL LIFE.

Until the systematic colonization of the Islands, New Zealand was very destitute of terrestrial or animal life suitable to the wants of civilized man, the only animals being a small rat, a dog (which had probably been introduced since the Islands were peopled by the present race), and pigs, the produce of some animals left by Captain Cook and the navigators that succeeded him: through the agency of the early missionaries, and by whaling ships, many useful animals and plants were then introduced. In more recent years all kinds of domestic animals, many of very high quality, have been imported, including valuable breeds of sheep and the American llama. Domestic poultry of almost every species have also been introduced, and, through the agency of the Acclimatization Societies, many species of game (such as hares, pheasants, partridges, black-game, red grouse, quail, &c.) and a host of the smaller birds of Europe and other countries have been spread throughout the Islands. The rivers also of New Zealand, which formerly produced only the eel and a few small salmonoid fishes of little value, are gradually being stocked with salmon and trout, both European and American, while perch, tench, and carp have also been satisfactorily acclimatized.

There are now in New Zealand about fourteen million sheep, seven hundred thousand cattle, and one hundred and sixty thousand horses.

WHALING.

New Zealand is the chief centre of the southern whale fisheries, and at certain seasons the less frequented harbours are visited by whalers for the purpose of refitting and carrying on shore-fishing and barrelling their oil. These are generally American ships, but Otago and Auckland whaling ships are also equipped by New Zealand owners. The sperm whale abounds in the region of the ocean lying to the north-east of New Zealand, but stragglers are found all round the

coast. In the open sea and to the south the most prized whale next to the sperm is the black whale, or tohoro *(Eubalæna australis)*, which is like the right whale of the North Sea, but with baleen of less value. Along the shores the chief whales captured are the hump-back *(Megaptera)* and rorqual *(Sibbaldius)*, which become very abundant when not disturbed for a few years.

Value of Whale Oil.

In 1875, 20,845 gallons of black oil were exported, valued at £4,100, and 7,775 gallons of sperm, valued at £2,894. In 1877, 15,847 gallons of sperm-whale oil were exported, valued at £4,032. In 1881, 20,686 gallons of sperm-whale oil were exported, valued at £5,059. In 1884, 16,722 gallons of black oil, valued at £2,456, and 25,021 gallons of sperm-whale oil, valued at £5,547, were exported.

Seal Fur.

The sea-bear, or fur seal *(Arctocephalus cinereus)*, is found on the remote parts of the coasts, about a thousand skins being taken every year by boating parties. In 1875 there were exported 2,767 seal-skins, valued at £4,050; and in 1877 there were exported 1,503 seal-skins, valued at £1,652. In 1881, 1,259 seal-skins were exported, valued at £1,717. In 1884 the number had fallen to 374, of the value of £380.

FISHERIES.*

The assemblage of fishes which we find in the New Zealand seas on the whole represent the characteristic forms of the southern or Lusitanian province of European coasts, or, in other words, our New Zealand fishes resemble those which are found on the coast between Madeira and the Bay of Biscay more than they do those which are caught about the North of Scotland. Of thirty-three sea fishes that are used as food in New Zealand, we have among the constant residents on all parts of our coast the Hapuku, Tarakihi, Trevally, Moki, Aua, Rock Cod, Wrasse, and Patiki; and while the Snapper, Mullet, and Gurnet are only met with in the North, the Trumpeter, Butterfish, and Red Cod are confined to the South. But, with the exception of the Patiki, or Flounder, and the Red Cod, none of these are representatives of fishes that are common even in the South of Britain, while from the more northern seas similar fishes are altogether absent.

* A more detailed account of the edible fishes of New Zealand, illustrated by wood-cuts, forms the subject of a separate pamphlet.—J. H

In addition to those which remain throughout the year, a very large number of the fishes of the New Zealand coast, owing to its geographical position, are pelagic in their habits, and roam over a wide range of ocean, visiting our shores only irregularly in pursuit o food. Of the edible fishes of this class, by far the largest number are visitors from warmer latitudes, such as the Frost-fish, Barracouta, Horse-mackerel, King-fish, Dory, Warehou, Mackerel, and Gar-fish, while only the Ling, Hake, Haddock, and a few other fishes, which are rare, and worthless as food, are among those of more southern types which reach the New Zealand coast in their migrations.

There is, however, no reason to complain of any want of useful variety in the New Zealand fishes as compared with Britain, for we find that out of 208 species of fishes enumerated as occurring in the British seas, including many which are extremely rare or only occasional visitors, only forty are considered to have a marketable value. In New Zealand, notwithstanding our very imperfect knowledge (especially with regard to the gregarious tribes, which there is reason to believe inhabit shoals at some distance from land), out of 192 sea fishes, some of which are only known from single specimens, we have nearly as many varieties used for food as are brought to market in the British Islands.

In 1885, an Act entitled "The Fisheries Encouragement Act, 1885," was passed, offering the following export bonuses for the establishment of the fish-canning and curing industries: (1.) 1d. per lb. for the first 200 tons of fish canned with or without oil, not including the weight of the cans; and ½d. per lb. for every ton beyond the first 200 tons. (2.) ¼d. and ⅛d. per lb. for cured fish under similar conditions. The Act is valid for seven years, and the total tonnage upon which bonuses may be granted is 6,000 tons. It is further provided that every intending applicant for the bonus shall register a special trade mark. Fish-canning and curing establishments are already in existence in various parts of New Zealand.

Of 140 species of fish enumerated as found in New Zealand, sixty-seven species are, so far as we know, peculiar to New Zealand; seventy-five are common to the coasts of Australia or Tasmania; while ten species are found in New Zealand and other places, but not in the Australian seas. New Zealand Ichthyology thus presents a very distinct character, the thorough deciphering of which affords a wide field for future observation and scientific investigation.

The following is a list of the fishes which are chiefly met with in the market:—

Hapuku	Oligorus gigas
Kahawai	Arripis salar
Red Snapper	Anthias richardsoni
Snapper	Pagus unicolor
Tarakihi	Chilodactylus macropterus
Trumpeter	Latris hecateia
Moki	Latris ciliaris
Frost-fish	Lepidopus caudatus
Barracouta	Thyrsites atun
Horse-mackerel	Trachurus trachurus
Trevally	Caranx georgianus
King-fish	Seriola lalandii
John Dory	Zeus faber
Boar-fish	Cyttus australis
Warehou	Neptonemus brama
Mackerel	Scomber australasicus
Rock Cod	Percis colias
Gurnard	Trigla kumu
Mullet	Mugil perusii
Sea-mullet	Agonostoma forsteri
Spotty	Labrichthys bothryocosmus
Butter-fish	Coridodax pullus
Haddock	Gadus australis
Red Cod	Lotella bacchus
Whiting	Pseudophycis breviusculus
Ling	Genypterus blacoides
Turbot	Ammotrites guntheri
Brill	Pseudorhombus scaphus
Flounder or Patiki	Rhombosolea monopus
Sole	Peltorhamphus novæzealandiæ
Gar-fish	Hemirhamphus intermedius
Grayling	Prototroctes oxyrhynchus
Smelt	Retropinna richardsoni
Kokopu	Galaxias fasciatus
Minnow	Galaxias attenuatus
Sand-eel	Gonorhynchus greyi
Anchovy	Engraulis encrasicholus
Pilchard or Sardine	Clupea sagax
Sprat	Clupea sprattus
Eel (tuna)	Anguilla aucklandii
Black eel	Anguilla australis
Conger-eel	Conger vulgaris
Silver-eel	Congromuræna habentata
Leatherjacket	Monacanthus convexirostris
Smooth-hound	Mustelus antarcticus
Sting-ray	Trygon thalassia
Skate	Raja nasuta

GEOLOGY.*

The geological reports, maps, and sections which are issued by the Geological Department of New Zealand indicate our present knowledge of the structure of the Islands and the distribution of the chief groups of rock formations; and the following classification has been adopted in the construction of the geological maps; but, notwithstanding, the large amount of data that has been collected, the extent and rugged nature of the country and the very limited staff have precluded minute surveys being effected, so that any attempt made to express the results obtained in a systematic form must be considered as merely provisional.

* A detailed account of the geological and mineral products of New Zealand, illustrated by figures of the typical forms, sections, and map, appears in a separate "Detailed Catalogue and Guide to the Government Exhibits, Indian and Colonial Exhibition, 1886."—J. H.

Distinctive Colour.	Classification.
Yellow.	*I. Post-tertiary and Recent.
	II. Pliocene.
Orange.	III. Upper Miocene.
	IV. Lower Miocene.
	V. Upper Eocene.
Green.	VI. Cretaceo-tertiary.
	VII. Lower Greensand.
Blue.	VIII. Jurassic.
	IX. Liassic.
	X. Rhætic and Trias.
	XI. Permian.
Sepia.	XII. Carboniferous.
	XIII. Devonian.
	XIV. Upper Silurian.
	XV. Lower Silurian.
Purple.	XVI. Foliated Schists.
Crimson Lake.	XVII. Granite and Crystalline Schists.
Carmine.	XVIII. Basic Volcanic, Plutonic, and Dyke Rocks.
Pink.	XIX. Acidic Volcanic Rocks.

I. Post-tertiary (Recent).—The deposits belonging to this period have accumulated with great rapidity in New Zealand, owing to the mountainous character of the country giving to the rivers, even when of large size, the character of torrents, which are liable to occasional floods of extreme violence. To some extent, also, the remarkable indications of change which are everywhere manifest must be attributed to alterations of relative level which have affected the surface, some of which have occurred during the present century. Such changes are more easily detected on the sea-coast, where they effect sudden alterations of the shore-line, but there is no doubt that they have been equally potent in inland districts, and have caused, for instance, marked alterations in the courses of some of the rivers.

The Maori race is considered, from the evidence afforded by their traditions, to have been established in New Zealand for little more than five hundred years before the first arrival of Europeans; but during that period, while the Islands were being explored in all parts by this intelligent and adventurous native race, the spread of fires,

* These numbers refer to the colours on the geological maps.

causing the destruction of the primæval forests and rank vegetation, was the means of setting free vast accumulations of loose soil and disintegrated rock that were formerly retained on the mountain-slopes. The material thus displaced has accumulated in the river-courses, causing them to raise their beds above the adjacent lands, so that they have broken away from their channels in many places.

The race of gigantic Moa birds *(Dinornis)* had its maximum development in the New Zealand area, aud only became extinct during the recent period, but their extermination must have commenced at an earlier date than the first human occupation, as their bones are found deeply embedded in the gravels and swamps, while the evidences of human occupation are confined to the surface-soil, shelter-caves, and sand-dunes.

II. Pliocene.—This formation belongs to a period when New Zealand was the mountain-range of a greatly-extended land-area, and when, in the North Island, the volcanic forces had their greatest activity, attended with the rapid elevation of local areas of fossiliferous deposits that were at this period forming in adjacent seas. In the South Island no marine deposits of importance belonging to this period are present, but the great area of land above the shore-line intensified the erosive action of the glaciers radiating from the mountain-centres, and gave rise to enormous deposits of gravel, such, for instance, as compose the greater part of the Canterbury Plains, and the Moutere Hills in Nelson.

The economic importance of this formation is very considerable, from its containing the richest deposits of alluvial gold that form the support of the mining population. The beds cover a considerable surface-area, both in the North and also in the South Island.

III. Upper Miocene.—The marine beds of this age consist of a series of sandy, calcareous, and argillaceous strata, the distribution of which, and as a rule also the mineral character, indicate that they were related to a closely adjacent shore-line, as they often pass, almost suddenly, from coarse conglomerates into narrow strips of fine mud and clay, such as are deposited in the centres of deep channels and inlets.

IV. Lower Miocene.—This formation, which is distinguished from the foregoing chiefly by its fossils, is a calcareous and argillaceous formation, widely spread over the east and central part of the North Island and both sides of the South Island, and, when not removed by denudation, can be traced to an altitude of 2,500 feet above the sea. It represents a period of great depression, and the deposits are remarkable for the absence of evidence of volcanic activity in any part of the region, and for the abundance of marine life.

V. Upper Eocene.—This is a very marked formation of calcareous sandstone, composed of shell fragments, with corals and Bryozoa, and is a shallow-water and littoral deposit.

Intense volcanic activity prevailed during this period in both Islands, and the calcareous strata are frequently interbedded with contemporaneous igneous rocks and tufas, and in the North Island are often replaced by wide-spread trachyte flöes and volcanic breccias.

The lower part of this formation passes at places into an imperfect nummulitic limestone, or a friable calcareous sandstone, evidently deposited in shallow seas, and forming the lowest member of the proper marine Tertiary series.

VI. Cretaceo-tertiary.—This constitutes the Cretaceo-tertiary group, being stratigraphically associated and containing many fossils in common throughout, while at the same time, though none are existing species, many from even the lowest beds present a strong Tertiary facies, and in the upper part only a few are decidedly Secondary forms.

The distribution of this formation shows that it was not like the foregoing formations of later date, deposited in relation to a form of the land like that at present obtaining in the New Zealand area, except in the vicinity of some of the oldest and most lofty land-masses in the south, which appeared to have remained above the water-line since the Lower Cretaceous period.

The upper part of this formation is a deep-sea deposit, but the lower subdivisions indicate the close vicinity of land, and are replaced in some areas by true estuarine and fluviatile beds containing coal.

The most valuable coal deposits of New Zealand occur in the Cretaceo-tertiary formation, but always at the base of the marine beds of the formation, in every locality where they occur. The coal-bearing beds always rest upon the basement rock of the district, marking a great unconformity and the closing of a long-persistent land-area at the period to which they belong.

VII. Lower Greensand.—This formation consists of green and grey incoherent sandstones, with hard concretions, and large masses of silicified wood.

It is confined to a few localities of limited extent, is very rich in fossils of the genera *Belemnites* and *Trigonia*, with a few Saurian bones and large Chimæroid fishes.

VIII. Jurassic.—These beds, which are the youngest of the Lower Secondary formation in New Zealand, consist in the upper part of estuarine beds, marine fossils being absent or rare.

Following these are marlstones, represented in southern districts by coarse-grained sandstones, which pass near the base of the forma-

tion into conglomerates with bands of indurated shale, enclosing plant-remains and irregular coal-seams, which have been included in the next group as its upper member.

They are all of marine origin, and contain Middle and Lower Oolite fossils.

IX. Lias.—This formation consists in its upper part of conglomerates and sandy grits, with plant-remains too indistinct for identification; and in the lower of marly sandstones in banded layers of different colours, at the base having a concretionary structure, which has led to their being termed "the cannon-ball sandstone:" similar sandstones also occur in the Otapiri formation.

X. Trias.—It has been found necessary to include in this formation a thickness of strata which is quite unusual in other parts of the world; but the close connection which exists throughout, founded on both palæontological and stratigraphical grounds, and the clearly-defined Permian character of the next underlying formation, renders this classification absolutely necessary.

XI. Permian.—The mineral character of this formation is grey and green sandstone with breccia and heavy conglomerate beds. Marine fossils have only been found at 1,000ft. below the great conglomerate that divides its two sections.

XII. Lower Carboniferous and Upper Devonian.—This formation is of considerable importance from the large share it takes in the structure of the great mountain-ranges, and from the occasionally great development in it of contemporaneous igneous rocks, with which are associated metalliferous deposits. In the upper part this formation consists of fine-grained argillaceous slates (Maitai slates of Hochstetter), becoming calcareous and passing into true limestones at their base. These limestones, which close the Maitai series, contain Lower Carboniferous fossils.

Succeeding these is an enormous thickness of greenstone breccias, aphanite slates, and diorite sandstones, with great contemporaneous flöes and dykes of diorite, serpentine, syenite, and felsite belonging to the Upper Devonian period.

XIII. Lower Devonian.—These, as determined by their fossil contents, have only been distinguished in one locality, viz., Reefton, although from their mineral character they are evidently present in many other parts of the South Island.

XIV. Upper Silurian.—Many areas of metamorphic schists should probably be included in this formation, but it has only been distinguished by its fossil contents in the north-west district of Nelson, where both Upper and Lower Silurian rocks are present.

The Upper Silurian rocks consist of grey cherts, sandstones, and calcareous slates, with occasional beds of blue limestone.

In the Baton River they contain a great variety of fossils in the calcareous strata, and not infrequently in the sandstones and cherts, of which thirteen species have been determined, besides which a great variety of corals and corallines occur; crinoids also are very abundant.

XV. Lower Silurian.—These rocks form the mass of Mount Arthur and the range to the north-east as far as Separation Point, and they consist chiefly of a dark bituminous slate, associated with a blue or grey submetamorphic limestone, which is in places developed to a very large extent. White crystalline limestones are also associated with these beds throughout the whole length of the district from Mount Owen to Motueka.

The whole series is disturbed by eruptive hornblendic and syenitic rocks, which are probably of Devonian age.

Fossils have been found in two localities only, and these consist entirely of encrinite remains, one species of coral not yet determined, and Graptolites which occur in the slates.

The central axis of these beds consists of true mica-schists, to the east and west of which the limestone and bituminous slates overlie.

XVI. Foliated Schists.—The metamorphic rocks under this division have as yet been only subdivided according to their mineral character; but they probably consist chiefly of altered Silurian rocks, and even those of formations as young as the Maitai or Lower Carboniferous beds. The less metamorphosed areas of Lower Palæozoic rocks in the South of New Zealand have yielded no fossils. They were formerly classed as the Kaihiku series, but this name has latterly been transferred to the Permian formation of which the Kaihiku Range is more largely composed.

XVII. Crystalline Schists and Granite.—The south-western portion of the District of Otago is composed of crystalline rocks, forming lofty and rugged mountains, of which the chief characteristic is their cubical form, due to their being intersected in all directions by profound but narrow valleys, with abrupt precipitous sides to three-fourths of the extreme height of the adjacent mountains. The valleys are occupied on the west by arms of the sea, and on the east by those of inland lakes that resemble the Norwegian fiords, and present most wonderful mountain scenery.

The base rock of this formation is foliated and contorted gneiss corresponding to Humboldt's gneiss-granite of South America, and associated with it are granite, syenite, and diorite, which belong to the next group.

Wrapping round these crystalline strata, and sometimes rising to an altitude of 5,000ft. on its surface, is a series of hornblende schists, soft micaceous and amphibolic gneiss, clay-slate, and quartzites, associated with felstone dykes, serpentine, and granular limestone. I believe these latter to be metamorphic rocks of not very ancient date, probably of Devonian age.

Areas within the crystalline schists where true granite occurs, either metamorphosed or in the form of perfect dykes, have been distinguished under this group.

Granites of a light-grey colour and very fine grain are found in the Nelson and Westland Districts, forming isolated hills along the boundary of the Foliated Schists on the east and Lower Devonian beds on the west. In the south-western extremity of New Zealand, at Preservation Inlet, coarsely crystalline granites, of white and flesh-colour, appear to break through and overlie the younger members of the crystalline schists.

Igneous Rocks.

XVIII. Basic Volcanic, Plutonic, and Dyke Rocks.
XIX. Acidic Volcanic Rocks.

Or, if grouped according to age, as in the geological sections,—

A. Volcanic group. Recent and Post-tertiary.
   a. Basaltic.
   b. Rhyolitic.
B. Trachytic group. Eocene.
   a. Trachyte-porphyries.
   b. Trachyte-breccias.
C. Dolerite group. Upper Cretaceous.
   a. Trachy-dolerites.
   b. Anamesites.
D. Propylite group. Lower Cretaceous.
E. Diabase group. Triassic.
F. Diorite group. Lower Carboniferous.

The igneous rocks have played an important part in almost every formation in New Zealand, marking great movements of the earth's crust at the different geological periods, while the superficial and later-formed volcanic rocks occupy nearly one-third of the area of the North Island.

They are divided on the map into the above groups, of which the plutonic and dyke rocks include syenite and diorite, with associated breccias, serpentine, and olivine rocks (dunite), the eruption of which took place in the Upper Devonian period.

These rocks are found on a line which extends almost continuously through the South Island; but diorite rocks reappear in the extreme north of Auckland, and on the Cape Colville Peninsula and Great Barrier Island. They are generally more or less metalliferous, chrome and copper being the ores of most frequent occurrence.

Basic Volcanic Rocks.—These belong to three different periods, when there were active eruptions, attended by the formation of flöes of both compact igneous rocks and tufaceous breccias.

The earliest of these occurred during the Triassic period, and consists chiefly of diabase and serpentinous breccias. The next eruptions took place about the close of the Jurassic period, along the eastern base of the Canterbury Alps, where the rocks occur in dome-shaped mountains as melaphyres associated with felsite (quartz) porphyries which belong to the next group.

In the Cretaceo-tertiary period are massive trappean eruptions of trachy-dolerite and dolerite, while in the same period must be placed the propylite group, consisting of greenstone-trachytes, and fine- and coarse-grained breccia rocks, which form the matrix of the auriferous reefs of the Thames goldfields.

In Eocene times dolerite flöes were contemporaneous with the limestones of the period of the Hutchinson's Quarry beds, while lastly in this group have been placed the basaltic lavas of Pliocene age in the northern parts of the colony, and also certain dykes of vesicular lava that cut through and alter the Upper Pliocene gold-drifts in the Maniototo Plain, in the interior of Otago.

Acidic Volcanic Rocks.—The rocks belonging to this group have a similar distribution in time to the foregoing, the earliest being the felsite (quartz) porphyries, while trachyte porphyries and breccias played an important part during Cretaceo-tertiary and older Tertiary periods, scoriaceous lavas and rhyolites being the characteristics of the later outbursts, which have continued down almost to the present time.

The geysers and boiling springs in the North Island give rise to the formation of siliceous sinter, which must be included as the most purely acidic products of volcanic action, and as due to the decomposition of the older rocks by the action upon them of fresh water; but in the case of White Island, and other localities where the decomposition is brought about by the agency of sea-water, the sinter deposits are formed chiefly of sulphate of lime, and not silica.

MINING AND GEOLOGY: ECONOMIC MINERALS.

Coal.

Coal mines are being worked in the Provincial Districts of Auckland, Nelson, Canterbury, and Otago (including Southland).

The different varieties of coal may be classed as follow:—

Class I.—*Hydrous*, containing an excess of combined water.
- Lignite.
- Brown coal.
- Pitch coal.

Class II.—*Anhydrous*, containing very little combined water.
- Glance coal.
- Semi-bituminous coal.
- Bituminous coal.

I. Hydrous Coal, containing 10 to 20 per cent. of permanent Water.

Lignite shows distinctly woody structure; laminated; very absorbent of water.

Brown Coal rarely shows vegetable structure; fracture irregular, conchoidal; colour dark-brown lustre feeble; cracks readily on exposure to the atmosphere, losing 5 to 10 per cent. of water, which is not reabsorbed; burns slowly; contains resin in large masses.

Pitch Coal.—Structure compact; fracture smooth, conchoidal; jointed in large angular pieces; colour brown or black, lustre waxy; does not desiccate on exposure, nor is it absorbent of water; burns freely; and contains resin disseminated throughout its mass.

II. Anhydrous Coal, containing less than 6 per cent. of Water.

Glance Coal.—Non-caking, massive, compact or friable; fracture cuboidal, splintery; lustre metallic; structure laminated; colour black; does not form a caking coal, but slightly adheres. This variety is brown coal altered by igneous rocks, and presents every intermediate stage from brown coal to anthracite.

Semi-bituminous Coal.—Compact, with laminæ of bright and dull coal alternately; fracture irregular; lustre moderate; cakes moderately, or is non-caking.

Bituminous Coal.—Much-jointed, homogeneous, tender and friable; lustre pitch-like, glistening, often iridescent; colour black with a purple hue, powder brownish; cakes strongly, the best varieties forming a vitreous coke, with brilliant metallic lustre.

General Description.

Class I.—The *Hydrous Coals* of the South Island occur on the eastern coast chiefly.

Pitch Coal has been worked since 1867 at West Wanganui, in Nelson; and in Otago at Shag Point, forty miles north of Dunedin, it

has been worked since 1862, together with brown coal. It is also found at Reefton, Nelson, where it contains resin disseminated throughout its mass; Waikato and Whangaroa, Auckland; Morley Creek, Southland. It belongs to the Upper Cretaceous period, and has an evaporative power of 5·2lb.

Brown Coal is extensively worked in Auckland, on the Waikato River, and in the Kaitangata Mine, Clutha district of Otago, where the seams are from 5 to 20 feet thick. The area of this latter coalfield is about 6,000 acres, and the quantity of coal has been estimated from surveys to be 140,000,000 tons, nearly the whole of which would be available without sinking. In the same provincial district thick seams of brown coal in grits and clay-shale have been worked since 1861 at Green Island and Saddle Hill, and extensive seams exist in Southland, and to the west of Riverton, which have not yet been regularly mined. It belongs to the age of the Upper Greensand, and has an average evaporative power of 4·2lb. to 5·6lb.

The *Lignites* of Lower Miocene age occur in the interior of Otago and at other places in superficial deposits of limited extent, and have been used chiefly by gold-miners.

Class II.—The *Anhydrous* kinds of coal prove to be quite equal to any imported, experiments having been undertaken in 1865 for ascertaining their value as steam coals. Both these and the hydrous coals occur at the base of a great marine formation, underlying limestone, clays, and sandstone of Cretaceous and Tertiary age, which have a thickness of several thousand feet, the coal-seams occurring whenever the above formation is in contact with the basement rock. The anhydrous kinds are more limited in distribution, and appear to have been produced by local disturbance of the strata, and in some cases are evidently due to the intrusion of volcanic rocks.

Bituminous Coal is worked chiefly in the Nelson District. At Mount Rochfort or Buller mines the seams are on a high plateau, and are 10ft. to 40ft. thick, and from 900ft. to 3,000ft. above sea level. Accurate surveys of this coalfield show it to contain 140,000,000 tons of bituminous coal of the best quality and easily accessible. A Government railway seventeen miles in length is now completed along the level country at the base of the ranges in which the coal occurs, and from which it is lowered by incline planes constructed by the coal-mining companies. The principal mine is the Banbury, which has a magnificent seam of hard bituminous coal at an altitude of 1,800ft. above the sea-level. At the Brunner coal mine, on the Grey River, Nelson, the working face of the seam is 18ft., and it has been proved to extend one-third of a mile on the strike

without disturbance, and to be available for working in an area of thirty acres, the estimated amount of coal being 4,000,000 tons in this mine alone, most of which can be worked above the water-level. Coal-Pit Heath is a second mine lying more to the dip of the same seam. A third mine was for a time opened on the south side of the river, which, with a 370-ft. shaft, will command 300,000 tons. The coal from the Brunner Mine, Nelson, which has now been worked for fifteen years, yields vitreous coke, with brilliant metallic lustre. Average evaporative power of several samples, 7½lb. of boiling water converted into steam for each pound of coal. It occurs with grits and conglomerates of Upper Mesozoic age, corresponding to the horizon of the Gault or Lower Greensand. A railway has been constructed by Government to connect the mine with the port, and harbour improvements are in progress, whereby a larger class of vessels than at present will be enabled to enter the river. The small quantity of this coal hitherto obtainable in New Zealand and Australian markets has been eagerly bought up for gasworks and iron foundries, which generally pay for it from 10 to 20 per cent. more than for any other coal. Engineers of local steamers esteem it 20 per cent. better than the best New South Wales coal for steam purposes. Coke made from it is valued at £3 per ton.

Coalfields in other parts of the Nelson District have also yielded excellent coal. At Murray Creek, Inangahua, an 18-ft. seam of semi-bituminous coal is worked, associated with quartz grits. At Pakawau, and in the same formation at Collingwood, thin seams of hard bright bituminous coal have been worked from the sandstones of the Cretaceous period. The area of the coalfield is about thirty square miles, and the facilities of access and shipping and the abundance of iron ore and limestone will probably make this an important mining district. The chief coal mine has been opened by a tunnel 700ft. in length, piercing the mountain at 600ft. above the flats along the Aorere River, the coal being brought down by a self-acting incline. This description of coal also occurs in the irregular seams in sandstone of Upper Mesozoic age (Jurassic and Lower Cretaceous), at Kawakawa and Whangarei, Auckland; Mount Hamilton and Waikawa, Otago. It rarely cakes strongly, and has commonly an evaporative power of 6½lb.

Coal has been worked since 1865 in Auckland at the Kawakawa mine, Bay of Islands, from a seam 13ft. thick, under a roof of greensand; it contains much sulphur. A similar quality of coal is also worked at Walton's mine, and at the Kamo mine, Whangarei Harbour; and several important mines are opened in the coal-seams at the Malvern Hills, Canterbury.

Glance Coal.—This description of coal does not form a caking coke, but slightly adheres, and is a variety of brown coal, altered by faulting or by igneous rocks, and presenting every intermediate stage from brown coal to an anthracite. Occurs at Preservation Inlet and Malvern Hills, of Lower Cretaceous age, in extensive but detached seams from 2ft. to 6ft. thick in micaceous and argillaceous shales.

Coal Workings.

The first export of coal from New Zealand was made in 1866, amounting to 261 tons.

The following table shows the relative quantities of coal raised in the colony and imported during the seven years ending on the 31st December, 1884:—

	Raised in the Colony.	Imported.
1878 ...	162,218 tons ...	174,148 tons.
1879 ...	231,218 „ ...	158,076 „
1880 ...	299,923 „ ...	123,298 „
1881 ...	337,262 „ ...	129,962 „
1882 ...	378,272 „ ...	129,582 „
1883 ...	421,764 „ ...	129,752 „
1884 ...	480,831 „ ...	158,627* „

The first notable development of the coalfields was due to the great increase in the consumption of the Kawakawa coal, owing mainly to the circumstance that the Union Steamship Company adopted it for their coastal steamers, and reported most favourably of its utility as a steam coal; but now the coal mined near Greymouth and Westport is principally used for the same purpose.

The total quantity of coal imported during the period 1878–1884 was, from—

	1878. Tons.	1881. Tons.	1882. Tons.	1883. Tons.	1884. Tons.
New South Wales ..	172,254	127,501	126,258	124,852	153,634
Other sources	1,894	2,461½	3,324	4,900	4,149
	174,148	129,962½	129,582	129,752	157,783

The total quantity of coal exported during the same years was, to—

	1878. Tons.	1881. Tons.	1882. Tons.	1883. Tons.	1884. Tons.
New South Wales ..	400	2,870	1,253	1,350	5
Victoria	3,513	2,919	1,840	4,185	5,903
South Sea Islands ..	8	832	111	†987	†196
	3,921	6,621	3,204	6,522	6,104

* Including 844 tons of patent fuel.
† Including small shipments to China, New Caledonia, &c.

It appears from the table on p. 39 that the total consumption of coal in the colony during seven years from 1878 to 1884 has been 3,314,933 tons, of which 2,311,488 tons were derived from New Zealand mines. The total output of the coal mines of the colony up to the 31st December, 1884, was 3,005,120 tons.

It is not at all likely, however, that these figures will long continue to bear the same relative proportions, there being a fair prospect that the improvements now in progress for affording increased railway transport and better shipping facilities will give such a stimulus to this valuable industry that the output will be sufficient, not only for the supply of a fair portion of the home consumption, but also for a greatly increased foreign trade.

Gold and Silver.

Gold was discovered in 1842, less than three years from the foundation of the colony, but it was not practically worked until 1852, when the mines at Coromandel first attracted attention to the district of Cape Colville Peninsula, which still forms the chief centre of true lode-mining operations in New Zealand. The yield from those mines was up to 1880 over four and a half millions sterling, but is small when compared with the quantity of alluvial gold obtained in the South Island subsequent to 1861, at which date the goldfields of Otago became prominently known.

Quartz-mining.

The principal quartz mines in the North are in the Coromandel and Thames districts, about thirty miles apart. In these localities the reefs have been proved to a depth of over 600ft. below sea-level, but the best mines have as yet been principally confined to the decomposed and comparatively superficial rock. Veins have been discovered and gold obtained at all levels on the ranges from the sea-level to an altitude of 2,000ft. The quantity of gold that has been obtained from some of these quartz reefs is very great, and for considerable distances the quartz has yielded very uniformly at the amazing rate of 600oz. to the ton: such reefs are, however, very exceptional in New Zealand, as elsewhere. The value of such a yield may be better estimated by those not conversant with the subject, when it is stated that half an ounce to the ton is in most cases a profitable return.

Auriferous reefs are also extensively worked in the schistose rocks of Otago, and they occur at all altitudes, from sea-level to a height of 7,400ft., the most elevated gold mine in the Australasian Colonies being that opened during the year 1878 on the summit of Advance Peak, near Wakatipu Lake.

Several promising reefs have also been found in the Westland goldfields, amongst which may be mentioned a reef of auriferous stibnite at Langdon's Creek, near Greymouth, which yields from a few ounces to 99oz. of gold per ton; but up to the present time these reefs have not received the attention they deserve, except at Reefton and a few other localities. The importance of Reefton as a well-established mining district may be judged of from the fact that nine mining companies there during one year divided as profit the sum of £63,508 among the shareholders.

So far as this more permanent form of gold-mining is concerned, there is every reason to feel confident that it is still in its infancy in this colony, and that it only awaits the judicious application of capital for its development to a vast extent.

Alluvial Mining.

Alluvial gold is chiefly found in the South Island, in the Districts of Otago, Westland, and Nelson, in which mining operations are carried on over an area of about 20,000 square miles.

The auriferous sand, or gold drift, as it is usually termed, is of three distinct kinds.

Firstly, that which is found in the beds of rivers, and which is worked by small parties of miners, as the process requires no large expenditure of capital to effect the separation of the gold.

Secondly, immensely thick deposits of gravel of more ancient date occupy the wider valleys and the flat country, from which the gold can only be obtained by means of considerable expenditure and large engineering works for the purpose of bringing a supply of water for undermining and working the auriferous deposits. This description of mining is of a more permanent character than the former, and provision has been made by the Colonial Government for assisting the miners by the construction of water-races, which will supply the means of profitable employment to a much larger number of persons than at present gain a livelihood by it.

Some of these deposits are of considerable age, the cements of Tuapeka being certainly not younger than the lowest Tertiary deposits of the colony. They occur in beds from 300ft. to 500ft. thick, and cover a considerable area of country. These cements are treated in a different way from ordinary alluvial deposits, being crushed and washed in the same manner that a quartz reef is worked; but in consequence of the nature of the deposit as much as 150 tons of stone is put through the batteries in one day. They consist of coarse gravels and silts cemented together, carrying variable quantities

of gold, and were first found at the Blue Spur in Otago, and subsequently at a number of other places in the same district. At Charleston also, and elsewhere on the West Coast, auriferous cements are worked, but the localities first cited are those which to the present time have received the greatest attention. The yield of gold from these cement claims is small, but, in consequence of the large amount of material which can be operated upon, the value of the deposits is considerable, and their extent guarantees that they will afford a remunerative return for some time to come.

Thirdly, along the sea-coast the continued wash of the waves produces a shifting action on the sands which are brought down by the rivers and drifted along the shore, thus producing fine deposits of gold, the extraction of which, by the aid of simple mechanical contrivances, affords employment to a large number of diggers, who can labour without incurring the hardships and privations which attend the occupations of miners in the more inland districts.

The alluvial diggings at Collingwood were discovered in 1858; those of Otago in 1861; and in 1864 the goldfields near Hokitika proved a great attraction to the mining population of New Zealand. In Otago the gold drifts rest on the denuded surface of their parent rocks. The auriferous gravels in the western district, on the other hand, as a general rule, rest on the surface of Tertiary rocks of marine origin, and they have a general distribution parallel to whatever was the western shore of the Island at the time of their deposit.

The richest alluvial diggings in Westland usually occur in places very inaccessible for water supply, the streams having cut their channels much below the surface of the country, so that an organized system of irrigation is necessary to obtain the required amount of water for the gold-washing.

The following is the composition of New Zealand gold as exported from various districts:—

Melted gold from West Coast, Hokitika, Westland:		
Assay—Gold	... ...	·9627
Silver	... ...	·0363
Copper	... ...	·0010
Melted gold from Thames District, Auckland:		
Assay—Gold	... ...	·6565
Silver	... ...	·3390
Copper	... ...	.0045

Refined gold, as extracted by the chlorine refining process, and as exported by the Bank of New Zealand, Auckland :

Assay—Gold	... ...	·9942
Silver	... ...	·0058

The total quantity of gold entered for exportation from New Zealand up to the 31st December, 1885, amounted to 10,789,650oz., valued at £42,327,907.

The quantity exported in 1884 amounted to 246,393oz., valued at £988,953.

Silver and Silver Ores.

The silver exported from the colony has been chiefly extracted from the gold obtained at the Thames, which is alloyed with about 30 per cent. of the less valuable metal.

Within the last few years, however, several mines have been opened where the ore is argentiferous galena that yields 20oz. to 50oz. of silver to the ton. In some cases the galena is mixed with iron-pyrites that yields a fair percentage of gold.

A mine was formerly opened in Nelson, at Richmond Hill, where the ore is a form of tetrahedrite, a mixed ore, containing silver, antimony, zinc, bismuth, and copper, the silver being at the rate of from 20oz. to 1,792oz. per ton. The following is an analysis of the ore, which has been called Richmondite, after the locality in which it is found :—

Sulphide of lead	36·12
„ antimony	22·20
„ bismuth	traces
„ copper	19·31
„ iron	13·59
„ zinc	5·87
„ silver	2·39
Oxide of manganese	·52

The total quantity of silver entered for exportation from New Zealand from the year 1869, when it was first exported, up to the 31st March, 1885, amounted to 447,923oz., valued at £115,114. The amount exported in 1884 amounted to 24,914oz., valued at £5,125.

Iron Ores.

No iron mines are at present worked, though almost every known variety of iron ore has been discovered in the country ; the workings being limited to the black sands, which occur plentifully on the coasts.

There are also few soils or stream-gravels that will not yield a considerable quantity when washed. The chief deposits are, however, on the sea-shore of the west coast of both Islands, the best known being that at Taranaki.

Several companies have been formed both in England and the colony to manufacture steel direct from this ironsand. They have not, however, succeeded, but a partial success was attained by smelting, in furnaces, bricks formed of the ore with calcareous clay and carbonaceous matter, and recently the sand has been treated by a continuous cementation process that produces puddled blooms. It remains to be proved, however, if it can be profitably treated in large quantities by this or any other process. A company, called the New Zealand Iron and Steel Company, Limited, is now at work at Onehunga, for the purpose of making bar iron from the ironsand by a direct process, and has given notice of intention to claim the bonus of £1,000 offered by the Colonial Government for the production of 200 tons of wrought-iron blooms. According to the official returns, the iron exported from New Zealand since 1853 amounted to 207½ tons, valued at £1,066. The last shipment of this metal took place in 1869, and amounted to one ton.

Brown Hæmatite Ore.

At Parapara, Nelson, immense quantities of brown hæmatite ore occur on the surface of the ground. Some of this was converted into iron at Melbourne in 1873, and gave, on analysis,—

Iron	97·668
Manganese	·268
Carbon combined	·542
„ free (graphite)	·208
Silicon, with titanium traces	1·004
Phosphorus	·041
Sulphur	·269
	100·000

This iron has the following characters: Colour uniform, approaching white; structure homogeneous, and finely granular, hard, brittle. It is therefore the variety called white iron.

A further valuable deposit of brown hæmatite has been discovered by an officer of the Geological Survey Department on the west side of Mount Peel, where the deposit is about 60 feet thick. The ore contains 56 per cent. of metallic iron, and has been traced for a

distance of three miles, beyond which point it is reported to swell out to as much as a mile in width.

The following are the chief localities in which iron ore is found:

Specular Iron Ore.—Dun Mountain, Nelson. Occurs in irregular veins in greenstone rocks; contains 63 per cent. of metallic iron.

Specular Iron Ore.—Maori Point, Shotover, Otago. A 6-ft. vein in mica-schist, equally rich with the above; extent unknown.

Compact Iron Ore.—D'Urville Island, Nelson. Vein, thickness unknown, in diorite slate, with serpentine and chrome; yields 63 per cent. of iron.

Magnetic Iron Ore.—This valuable ore, though occurring chiefly as black sand, is found in several parts of the colony in the massive form.

Magnetic Iron Ore.—Dun Mountain, Nelson. In a vein 16in. thick in serpentinous slates.

Magnetic Iron Ore.—Wakatipu Lake, Otago. In a vein in mica-schist.

Magnetic Iron Ore.—Maramarua, Frith of Thames. From a vein in ferriferous slates; contains only oxides of titanium and manganese.

Black Ironsand.—From beach at Taranaki.

Iron-band Ore.—Contains 70 per cent. of iron. Occurs at Wyndham River, Otago, and Manukau, Auckland; formed by black-sand layers becoming cemented with hæmatite. This would be a most valuable ore if obtained in large quantities.

Brown Hæmatite, or hydrous oxide, also occurs in Amuri in great quantity.

Reniform Iron Ore, Mongonui.

Bog Iron Ore.—Spring Swamp, Auckland. Forms thick layers at the bottom of swamps. Though rich in iron, the ore is inferior on account of the sulphur and phosphorus it usually contains.

Hæmatite.—An analysis of this ore, from Raglan, gave—

Sesquioxide of iron	72·69
Oxide of manganese	·31
Alumina	2·02
Magnesia	·69
Lime	·58
Phosphoric acid	not estimated
Sulphide of iron	·11
Hygroscopic water	4·61
Constitutional water	13·02
Silicates undecomposed by acids	5·97
	100·00

Ironsands.

The following tabular statement gives a particular account of ironsands :—

IRONSANDS OF NEW ZEALAND.

Locality.	Matrix whence probably derived.	Magnetite.	Hæmatite.	Titanite.	Per-centage of Iron.	Other Minerals present.
Upper Buller River, Nelson ..	Hornblende rocks	87·5	9·4	..	70·2	
Lower Buller River Nelson ..	Tertiary gold-drift of diorite slate..	54·0	..	42·3	59·0	Auriferous.
Upper Molyneux River, Otago ..	Mica-schist	82·7	..	9·7	65·9	Auriferous.
Lower Molyneux River, Otago..	Mica-schist and Tertiary strata ..	74·4	..	2·5	58·7	Auriferous and with 12 per cent. of glauconite.
Mountain stream, Canterbury ..	Palæozoic slates	62·7	37·2	..	66·2	
Mountain stream, Otago ..	Palæozoic slates	86·1	10·5	..	58·5	Auriferous.
Tuapeka, Otago	Old gold drift	2·2	92·8	..	63·8	Auriferous.
Wakatipu, Otago	Mica-schist	80·0	7·6	..	52·9	Auriferous.
Mataura River (Upper) ..	Diorite slate	9·8	..	70·9	41·2	
Mataura River	Old gold drift	63·5	16·1	8·0	60·6	
Stewart Island	Granitic rocks with greenstone dykes	77·8	..	20·1	57·3	Auriferous.
Stewart Island	Hornblende rocks	71·5	20·0	8·2	70·1	Auriferous.
Anatoke, Nelson	Granite and hornblende	79·8	7·7	3·4	60·2	Auriferous.
Mahinapua Lake (old channel of Hokitika)	River drift from diorite rocks ..	..	..	58·0	29·1	Auriferous, with garnets, topaz, disthene, &c.
Sea-beach, Hokitika	Sea-sand drift	75·0			54·0	Auriferous.
Motueka River, Nelson ..	Tertiary strata and granite ..	33·0	32·5		42·0	Auriferous.
Wairau River, Marlborough ..	Tertiary strata and granite-schist..	21·0	48·4		38·9	Auriferous.
Wanganui River, Nelson ..	Granite and Tertiary	54·0	13·0		43·2	Auriferous.
Saddle Hill, Otago	Basaltic	58·3	..	25·6	52·9	
Green Island, Otago	Basaltic or sea-beach	53·3	..	29·6	50·3	
Hooper Inlet	Basaltic or sea-beach	20·0	74·2		53·0	
West Bluff, Southland, Foveaux Strait	Diorite or sea-beach	12·2	..	40·6	28·6	Auriferous and platiniferous.
D'Urville Island, Nelson ..	Diabase and granite	78·6	..	..	57·4	Chrome iron.
Taranaki beach	Trachyte	91·9	..	6·2	70·1	
Taranaki beach	Trachyte	71·0	..	8·0	56·1	Olivine and hornblende.
Tauranga beach	Trachyte	87·4	8·6	..	68·0	

The composition of the chief massive ores of iron may be illustrated by the following analyses :—

MASSIVE IRON ORES, OXIDES, AND TITANITES.

Variety.	Locality.	Centesimal Composition.					Percentage of Iron.
		Magnetite.	Hæmatite.	Titanic Iron.	Siliceous Matters.	Water.	
Impure magnetite	Manukau, Auckland ..	60·20	37·90	traces	1·90	..	70·06
Magnetic ..	Dunstan Gorge, Otago	86·32	..	traces	13·68	..	63·60
Hæmatite ..	Dunstan, Otago ..	..	96·11	..	3·89	..	68·30
Magnetite ..	Dun Mountain, Nelson	..	90·62	..	7·60	1·80	63·40
Mixed magnetite and hæmatite	Maramaru, Auckland	2·24	87·10	traces	10·66	..	62·30
Bog iron ore ..	Spring Swamp, Auckland	..	73·17	..	13·83	13·00	51·22
Brown iron ore	Raglan	..	72.69	..	9·68	17·60	50·88
Brown iron ore*	Kawau	..	67·98	..	19·65	12·37	47·58
Hydrous hæmatite†	Parapara, Nelson ..	..	62·68	..	24·08	13·24	43·87
Hydrous-hæmatite	Mount Peel, Nelson ..	..	..	..	..	..	56·00

* Manganese oxide, 1·38. † Contains a little manganese.

Spathic Iron Ore.—This occurs in considerable quantity in the Collingwood District, in most cases more or less oxidized; one form of this ore known as black-band is one of the most valuable kinds known, and alternates with the coal-seams in Collingwood. A specimen of a siliceous and spathic iron ore from Otamataura Gully is constituted approximately as follows :—

Carbonate of Iron	56·9
Carbonate of lime and magnesia ...	2·8
Siliceous matters...	40·3
	100·0

The iron amounts to about 27 per cent.

Other large deposits of spathic iron ore have been found at Foote's Coal Mine at the Miranda Redoubt, and Jenkins's Coal Mine, Nelson. They contain 40 per cent. and 41 per cent. of iron respectively.

BLACK-BANDS, OR SPATHIC IRON ORES.

Variety.	Locality.	Protoxide of Iron.	Sesquioxide of Iron.	Carbonic Acid.	Silicates.	Percentage of Iron.
Black-band	Collingwood, Nelson ..	35·23	25·77	21·12	3·93	46·06
Black-band	Collingwood, Nelson ..	40·38	5·26	21·97	16·69	35·12
Spathic ..	Miranda, Auckland ..	..	..	..	..	40·08
Spathic ..	Jenkins's Mine, Nelson ..	..	..	..	..	41·00

ANALYSIS OF TWO SPECIMENS.

	Spathic Iron Ores.	
	Malvern Hills.	Collingwood.
Protoxide of iron	51·2	35·23
Sesquioxide of iron	..	25·77
Oxide of magnesia	·8	1·00
Alumina	1·8	2·11
Magnesia	·4	1·94
Lime	·3	·71
Silica	13·6	·90
Sulphuric acid	..	traces
Carbonic acid	31·2	21·12
Phosphoric acid		not determined
Sulphide of iron	..	·41
Water	·7	1·96
Organic matter	..	5·72
Silicates undecomposed by acids	..	3·03
	100·0	99·90

Hæmatite, containing about 40 per cent. of iron, occurs intermixed with quartz pebbles, in a stratum 100ft. thick exposed over several acres, at Parapara, Nelson, and from it an excellent paint is manufactured, which, being a pure peroxide of iron, is the best preservative for that metal. Wood coated with this paint is comparatively non-inflammable, and it is therefore much used in painting wooden buildings.

CHROME ORE.

This ore, which is a mixture of chromic iron and alumina, is chiefly associated with magnesian rock, resembling olivine in composition, named *Dunite* by Dr. Hochstetter. It occurs in veins often 12ft. in thickness, and sometimes contains as much as 80 per cent. of chrome ore. This ore has been largely exported from Nelson, and is used for the manufacture of salts of chromic acid, possessing the properties of brilliant dyes. The pure ore contains 50 per cent. of the chrome oxide, and is worth £11 to £20 per ton, according to the state of the market. The exports of this ore since 1853 amount to 5,306 tons, valued at £37,367, but since 1866 no shipments have been made.

COPPER ORE.

Copper mines have been worked in Auckland on Great Barrier Island and Kawau Island, and to a small extent in Doubtless Bay. It has been found associated with the metamorphic rocks in Otago

and at Waipori, where a 4-ft. sulphide of copper (pyrites) lode exists. An attempt to trace this lode was made for a short time and then abandoned.

A carbonate of copper is found in the same locality, but only in rolled fragments.

Copper has also been found in the form of cuprite and copper-glance in the Dun Mountain, Nelson; and a few miles to the south in Aniseed Valley extensive works have been commenced by the Champion Mining Company; and on D'Urville Island, at which latter place the ore has been traced to a depth of 100ft., some of the better samples from this place yielding as much as 45 per cent. of copper.

A lode of copper-pyrites mixed with pyrrhotine has also been discovered in Dusky Sound, Otago, and an attempt has been made to open up a mine at that place.

An interesting occurrence of native copper disseminated as fine grains through a granular serpentinous rock should also be noted. The extent of the ore is as yet unknown, but it occurs in the serpentine mineral belt of Nelson.

Cupreous iron ore in serpentine has been found at Dun Mountain. It is interesting from its being slightly auriferous.

Copper-pyrites is present in a lode 3ft. to 5ft. thick in mica-schist, at Moke Creek, Wakatipu Lake: it is associated with carbonate and native copper. The ore contains the high proportion of 11 to 55 per cent. of metallic copper, the usual average of Cornish ore being only 5 per cent. There is limestone in close vicinity to the lode, so that there would be no difficulty in reducing the ore to a "regulus," in which state it would save cost in shipment.

Near Collingwood, Nelson, a lode has been opened up, and contains 22 to 25 per cent. of metallic copper.

Grey sulphide, found at Wangapeka, Nelson, contains 55 per cent. of copper, together with a little silver and gold.

In Kawau Island, Auckland, the lode first produced 16 per cent. of copper, and then fell off to 8 per cent., and at the bottom of the workings to about 5 per cent. The width of the lode was 8ft. The workings were discontinued chiefly on account of the high price of coal consequent on gold discoveries.

In Great Barrier Island the ore (pyrites) occurs in a quartz matrix. A fair sample of the mixed specimen afforded 26·62 per cent. of copper. The Otea Copper-Mining Company worked this pyrites ore to a considerable extent.

Up to 1878 2,370¼ tons of copper, valued at £36,217 were exported from the colony, but since then only small shipments of ore have been made.

Lead Ores.

Lead occurs as galena in the District of Nelson, at Rangitoto Mountain, in Westland, and also at the Thames Goldfield. It invariably contains silver to a considerable amount. The following localities may be mentioned:—

Galena from Bedstead Gully, Collingwood.

Galena and zinc-blende from Parapara Valley.

Argentiferous lead ore from Richmond Hill, Parapara; value £50 per ton.

Galena, Wangapeka, Nelson. Sulphide of lead, with quartz that contains also sulphides of iron, and antimony with gold, in veins in felspathic schist. The galena contains 26oz. of silver per ton, while the gold is only in those parts of the ore that contain iron-pyrites.

Galena with zinc-blende, Perseverance Mine, Collingwood, Nelson. Occurs in a band, 2ft. to 5ft. thick, parallel with auriferous quartz veins; the galena and blende are both pure, but so intermixed in the lode that they could not be reduced separately.

Argentiferous galena is also a common associate with the auriferous lodes of the Cape Colville Peninsula and Te Aroha districts.

Zinc Ores.

Zinc ore occurs at the Perseverance Mine, Collingwood, Nelson, and in small quantity in Tararua Creek, Thames, where it is found in white cement with auriferous veins. It contains 60 per cent. of metallic zinc, which is worth about £15 per ton.

It is also found in the following localities:—

Zinc-blende and galena from Bedstead Gully, Collingwood.

Zinc as yellow or honey blende from Perseverance Mine, Collingwood, Nelson.

Zinc-blende with galena and pyrites, the former having about 4oz. of silver and the latter about 5oz. of gold per ton, Mount Rangitoto, Westland.

Antimony Ores.

Stibnite lodes were discovered in 1873 near the coast of Queen Charlotte Sound, Marlborough, and proved to contain from 51·12 to 69·40 per cent. of antimony, the matrix being quartz. Similar lodes have been known for many years in the Shotover district, at Hindon, at Waipori, in the Carrick Mountains, and other places in Otago.

A sulphide-of-antimony lode occurs some miles south of Collingwood, containing no less than ·757 per cent. of silver, which is equal to 185·88 troy ounces per ton.

Besides these localities antimony ores are found at the Thames and at Reefton, associated with gold; and also at Langdon's Reef, near Greymouth.

At Endeavour Inlet, Cook Strait, antimony ore has been regularly mined, and is now being shipped to England. Arrangements are being made for the erection of smelting furnaces near the lodes.

In 1883 a bonus of £500 was offered for the production of the first 250 tons of antimony regulus to be sold in a foreign market at a fair market price, but no application was made for it, and it lapsed.

Manganese Ores.

These ores are useful for generation of chlorine for bleaching purposes, also for calico-printing, &c. The values of these common ores are from £3 to £4 per ton, and the following classes of them have been found:—

Rhodonite (silicate of manganese), at Dunstan, Otago, as rolled masses; percentage of manganese about 40.

Wad (hydrous oxide), at Port Hardy, D'Urville Island, Nelson; percentage of manganese about 45.

Braunite, or manganese oxide, on Malvern Hills, Canterbury.

Ores are also found at Whangarei in Auckland, at Ohariu near Wellington, and in Napier; the latter contains 44 per cent. of manganese oxide, the remainder being mostly clay.

The same ore, although of better quality, is at present being successfully worked in the Bay of Islands. The shipments for the year 1879 amounted to 2,140 tons, valued at £8,338. In 1881 the shipments were 1,271 tons, valued at £3,283, and in 1884 they amounted to 318 tons, valued at £808.

In 1883 a bonus of £500 was offered for the production of the first £2,500 worth of either manganeisen or manganese bronze, sold at a fair market price in a foreign market, but it lapsed without application having been made.

Mineral Oils.

In 1866 attention was first directed to the occurrence in the colony of petroleum, and some very fine oils have since then been found. There are three principal localities, and these produce each a distinct kind of oil:—

1. The Sugarloaves, in the Taranaki Provincial District.

2. Poverty Bay, on the east coast of the Provincial District of Auckland.

3. Manutahi, Waiapu, East Cape.

The oil from the first has a very high specific gravity, ·960 to ·964 at 60° Fahr. (water at 1). It has thus too much carbon in its composition for its commercial success as an illuminating oil, but is capable of affording a valuable lubricating oil. It resembles oil occurring in Santa Barbara County, California.

The second kind, from Waiapu, Poverty Bay, is a true paraffin oil resembling the Canadian oil. By three successive distillations, and treatment with acids and alkalies, about 65 per cent of a good illuminating oil is obtainable, with a specific gravity of ·843.

The third produces a pale-brown oil, nearly or quite transparent, specific gravity ·829 at 60° Fahr.; burns well in a kerosene lamp for some time, and is therefore of a very superior class; it contains only traces of paraffin, and produces 84 per cent. of an illuminating oil, fit for use in kerosene lamps, by means of a single distillation. By two more distillations 66 per cent. of the crude oil has a specific gravity of ·811, which is that of common kerosene.

At Sugarloaf Point, Taranaki, the petroleum (rock oil) oozes from cracks in trachyte-breccia. Wells have been bored to the depth of many hundred feet, but no steady supply of oil has been obtained.

A bonus of 6d. per gallon for the production of kerosene up to 50,000 gallons, in quantities of not less than 10,000 gallons at a time, was offered in 1874 and in 1885, but no applications were received for the same.

Oil Shales.

Petroleum Oil Shales.—Pyroschist, or bituminous shale, occurs to a small extent in the upper portion of the coal formation. Specimens have been examined from D'Urville Island, in Cook Strait; Mongonui and Waiapu, in Auckland; Kaikorai and Blueskin, in Otago; and at Orepuki, in Southland.

A good variety of oil-producing shale is obtained from the Chatham Islands, but it contains traces of sulphuretted hydrogen.

These shales have been distilled for oil, those from Mongonui and the Chatham Islands producing the following excellent results:—

Locality.	Centesimal Composition.					Relative Percentage of Volatile Matter.	Relative Percentage of Fixed Carbon.
	Volatile Matters.	Carbon.	Water.	Ash.	Sulphur.		
D'Urville Island ..	81·79	7·98	·69	9·54	traces	91·11	8·89
Mongonui	75·20	9·30	1·80	13·70	traces	88·99	11·01
Chatham Islands ..	66·43	20·41	4·61	8·55	traces	76·49	23·51
Chatham Islands ..	64·67	19·87	7·13	8·33	traces	76·49	23·51

Graphite.

The mineralized substance known as graphite—plumbago—black lead—consists of carbon in mechanical admixture, with siliceous matter, as clay, sand, or limestone, and in varying proportions, and is the ultimate product of vegetable remains, mineralized to the highest degree.

It has been found at Pakawau; in the vicinity of Wellington; and in the pure state embedded in marbles from the West Coast.

The pure amorphous variety is used for the manufacture of pencils, and for lubricants for machinery, while the impure siliceous or argillaceous graphites find extensive employment in the manufacture of crucibles, and for polishing material for ironwork.

Graphite of the first quality has not been found yet in any quantity in New Zealand, but there is an abundance of the less pure varieties. It has been found in greater quantity in the District of Nelson than elsewhere, but still many other localities yield this mineral in various states of purity, as at Malvern Hills, Canterbury, and Dunstan, Otago, where it is of fair average quality.

A valuable sample of graphite has lately been reported from Waiokura Creek, Waimate, although the mineral has not yet been found *in situ*. The following are analyses of two samples:—

	a.	*b.*
Fixed carbon	86·9 ...	92·5
Volatile matter	6·6 ...	4.5
Ash	6·5 ...	3·0
	100·0	100·0

This specimen is of a very homogeneous character, and if, as is probable, large bands should be found, the discovery may prove of great value. The colour of the ash is reddish-white.

Building Stones, etc.

Abundant supplies of excellent stones for roads and building purposes are found in every part of New Zealand. The varieties useful as such may be divided into—

1. Basalts and diorites;
2. Trachytes, granites, and crystalline schists;
3. Limestones (freestones in part);
4. Sandstones (freestones).

Basalts, locally called "bluestones," occur of a quality useful for road-metal, house-blocks, and ordinary rubble masonry. They are

found partly underlying and partly overlying the Tertiary rocks, interstratified with tufaceous clays and local beds of altered volcanic ash. In the North Island these volcanic rocks are largely developed, and include some of very recent date.

True lavas and scorias are of frequent occurrence in the northern part of the Island. The latter have been quarried by the prisoners at Mount Eden, Auckland; their colour is dark-grey, and though absorbent they are very hard and coherent.

In the South Island, on the other hand, the igneous rocks appear to be of much earlier date, and to have been nearly all of submarine origin. They are principally confined to the eastern seaboard, only rarely occurring at a greater distance than forty miles from the coast.

The Halswell quarries, Canterbury, produce an exceedingly hard and close-grained stone of a dull leaden-grey colour; but its excessive hardness will necessarily limit its usefulness.

Diorite.—This stone occurs on the west coast of Otago, at the Great Barrier Island, and in many other localities where it can be quarried.

Aphanite Breccia forms a solid building stone that has been used at Dog Island and elsewhere.

Porphyrites.—These stones are found at Flagstaff Hill, Water of Leith, and in the Malvern Hills.

Syenites occur at Dog Island and the Bluff, and at various localities on the West Coast and in Stewart Island; but the chief supply now available for industrial purposes is at the Bluff, and the Boulder Bank at Nelson, where a beautiful green variety occurs. It is hard, compact, and of a uniformly bluish-grey tint of great beauty; consequently it is suitable for kerbing, paving, and massive masonry, as well as for monumental and architectural work.

Trachytes.—The group of trachytes contains many varieties, both of composition and texture, but they all, together with the granites, are distinguished from the first group by containing a large proportion of silica.

At Port Chalmers a fine grey stone occurs. Another kind, a good freestone, is obtained at Harbour Cove, Otago, and Creightonville, Canterbury.

Granular trachytes are obtained from Governor's Bay, Lyttelton.

Trachyte porphyry is found at Taiaroa Head, Moeraki, and Portobello; and from Port Chalmers a breccia is obtained, with which the graving dock there is entirely built. All the kerbing in Dunedin is from the quarries of this stone.

Sanadine trachyte is found at Portobello, Otago Harbour.

Phonolite or clinkstone of a columnar character occurs at Bell Hill, Dunedin, and a laminated and spheroidal variety at Blanket Bay.

The gaol and some other old buildings of Dunedin are built of a spheroidal clinkstone, which is of a mottled grey colour, and exceedingly hard and compact. The foundations of buildings in that city are frequently constructed with the same stone, which is eminently suited for the purpose. This stone is probably metamorphosed tufaceous sandstone.

Granite.—Granite is only found as mountain masses at Preservation and Chalky Inlets, on the western coast of the South Island, but exists in large veins and blocks in Stewart Island, and along the whole of the West Coast.

At the first-named localities the granite is of a pinkish tinge with grey spots, and rather coarse in the grain.

The veins and blocks supply a fine-grained, beautifully-coloured stone, more suitable for architectural and monumental work than the former.

At Seal Island a fine grey granite vein occurs, having a smooth grain.

Granite rocks occur in detached areas in the Westland District, but not in accessible situations, being very different in that respect from those occurring on the south-west coast, where they admit of being quarried and shipped with great facility. At Astrolabe Island, and Tonga Harbour on the west shore of Blind Bay, is probably the easiest place from which granite could be quarried. It is there of fine quality, and can be quarried out in masses suitable for kerbing and harbour works.

A variety with garnets is found at Metal Mountain, Milford Sound.

Chrystalline Schists.—Gneiss of equally good quality with the granite from the south-west coast is to be found in many other inlets, and on the north shore of Milford Sound there is one point where there is an immense accumulation of blocks of a grey variety mottled with chrystals of garnet, and of all sizes and shapes, lying as if ready for shipment. Other localities are "Connecting Arm" and Anchor Harbour.

Marble.—The purest form of this series is found in many localities in the South Island; statuary marble occurs among the gneiss and hornblende schists of the West Coast. The grain of most samples hitherto found is rather coarse, but coarser-grained kinds exist in Caswell Sound, where a quarry has been opened, and also in the Mount Arthur district of Nelson.

Granular or crystalline and subcrystalline limestones of every shade and colour, texture and hardness, occur plentifully, chiefly in the South Island.

Extensive masses of the harder compact kinds occur in the Upper Palæozoic formations. They are generally speaking of a blue colour and unfossiliferous.

One mass or stratum occurs in the slates of the Kakanui Range; it is several hundred feet thick, with an outcrop of five miles in length, and is probably the best in the District of Otago.

A great variety of excellent limestones suitable for building stones might be obtained from the Horse Range (Shag Valley side); at Twelve-Mile Creek, on Lake Wakatipu; Malvern Hills, Canterbury; and Hokanui Hills, Southland. In the latter district a very fine kind is obtainable, very slightly coloured; it belongs to the Cretaceo-tertiary series.

A white granular limestone called the Oamaru stone is worked in extensive quarries in the Oamaru district; but it occupies a large tract of the country in the north part of Otago and throughout Canterbury, and has a remarkable uniformity of colour and texture; its weight, wet from the quarry, is 105lb. per cubic foot, and when perfectly dry 92lb. A considerable quantity has been exported to Melbourne.

The principal buildings of Dunedin are built of this stone, which shows a very fair amount of durability.

At Waiaroa, Auckland, there is a good hard close-grained stone, of a light, buff colour, mottled with black grains.

Earthy Limestone.

Freestone.—A fine limestone of a brown tint occurs near Dunedin, at Boat Harbour; it works freely, seems durable, and is said to exist in large quantities, and to be procurable in moderately-sized blocks; it has the disadvantage of not being in an easily accessible situation.

A hard, shelly, and white limestone, belonging to a younger formation than the Oamaru stone, occurs at Kakanui, and is used in some structures in that locality; it is of a uniform colour and consistency, is easily worked, and procurable in large blocks. The supply is unlimited.

Southland possesses a fair stone of this kind.

A valuable limestone occurs on the Otago Peninsula, near Port Chalmers, in two beds, one dark-coloured and the other yellow; the last contains a rather large amount of fine-grained sand, yellow and black. They burn to pretty good quicklime.

A good stone for lime occurs on Scinde Island, Napier; it is fossiliferous, and of Upper Tertiary age.

At Oamaru a compact variety of limestone is largely burnt for lime, but it is found in dislocated and concretionary masses intermixed with quantities of worthless rock, which gradually increases the expense of extraction. It is fossiliferous.

A hard very compact grey-coloured stone of considerable purity occurs near the Moke Creek copper lodes, and would afford the flux required for reducing the ore. It is fossiliferous, and of Lower Tertiary date.

Varieties.

Travertine Limestone is found at Dunstan Gorge, Otago; it makes very white lime. It has the usual porosity of this kind of stone.

Geodic Limestone.—This occurs at Hampden, Otago, and has numerous sparry cavities lined with crystallized calc-spar.

Cellular Limestone occurs at Nelson. This kind has numerous angular cells or holes.

A limestone breccia occurs at Ruataniwha.

Lithographic Limestone.—A lithographic limestone is found at Oamaru; it is a very fine-grained stone, hard and compact; its fracture is conchoidal. It occurs in concretions in the limestone, and not in slabs. The quarry is situated where the Lower Tertiary strata have undergone alterations by the extrusion of submarine igneous rocks, probably during their deposition. An extensive deposit of lithographic limestone also occurs at Abbey Rocks, near Paringa River, Westland, from which locality large slabs could be obtained. Lithographic limestone is also found in the Chatham Islands.

Chalk with black and white flints is found at Kaikoura Peninsula and in the northern part of Canterbury; a very pure bed of this material, which is of value for the manufacture of cement, occurring near Oxford.

Sandstones are very plentiful throughout the Islands, and are very varied in hue. The different kinds may be classed under the following heads:—

a. Siliceous sandstones, in which the cementing paste is a siliceous infiltration.

b. Calcareous sandstone, having carbonate of lime for its cohesive power.

c. Argillaceous sandstones, or claystones, in which clay replaces either of the above substances.

a. The true *Siliceous Sandstones* are found at the base of the Tertiary and in the Upper Secondary formations, where they are associated with beds of coal.

b. Calcareous Sandstones.—These are confined to the Upper Tertiary rocks, and are variable and concretionary.

c. Argillaceous Sandstones or Mudstones—Claystones.—These, like the last kind, are found only in the Upper Tertiary beds, and are variable.

Cement.

Natural-cement stones, or septaria, occur in the lower part of the marine Tertiary series, and in some cases are quite equal in quality to those which are burnt for the manufacture of hydraulic cement in Europe. The cement hitherto used so largely in New Zealand has been imported, but, with the great resources the colony possesses in the raw material for the manufacture, this will probably not be long continued.

Materials for Portland Cement.

The manufacture of Portland cement might be made an important industry in New Zealand, excellent chalk and lime and non-ferruginous clay being obtainable.

The Italian pozzuolana might be imitated also, as there are extensive deposits of volcanic tufas occurring in the North and South Islands. Those volcanic sands would require then to be ground up with an admixture of lime, making, when correctly proportioned, an excellent hydraulic mortar. In Auckland an artificial cement is largely in use, prepared from hydraulic lime from the Tertiary strata at Mahurangi, which, when properly mixed with scoria dust, forms a most valuable cement for concrete buildings, and also for submarine walls and docks. Artificial cement works are in process of establishment in Whangarei, New Plymouth, Collingwood, and in Canterbury and Otago at places where the natural supply of material occurs under favourable circumstances.

Bricks.

The materials for brick-making are plentiful throughout the country. The clays are admirably adapted for the manufacture of ths best kinds, and when properly weathered and tempered by mixing the clay into a perfectly homogeneous mass, and thoroughly burnt, the bricks are equal to any of British manufacture.

Pottery.

A bonus of £250 for £1,000 worth of earthenware was offered in 1881, and gained by a Dunedin pottery company.

The success of the pottery works that have been established at Tokomairiro, also at Christchurch and other places, has proved the adaptability of the fireclays and pottery clays of the colony for the best kinds of firebricks, drain-pipes, chimney-pots, tiles, and all kinds of pottery, porcelain, and terra-cotta goods.

CLIMATE.

Meteorological Observations.

Meteorological observations have been made ever since the founding of the colony, though at first they were of an irregular character, and only with the view of comparing the climate of New Zealand with that of other countries. From 1853, meteorological reports appear regularly appended to the Registrar-General's statistics; but it was not until 1859 that systematic observations were undertaken by a department established by Government. In that year, eleven stations, equipped with carefully-compared instruments, were established at Mongonui, Auckland, Napier, New Plymouth, and Wellington, in the North Island; Nelson, Christchurch, Dunedin, and Invercargill, and some years later at Hokitika and Bealey, in the South Island.

At a later date several new stations were established, making in all fifteen stations, from which monthly returns were sent to the head office in Wellington. Since then the number of chief stations has been reduced to three, and the number of secondary stations has been increased. From these the following returns are prepared for publication:—

I. A provisional return obtained by telegraph of the results at the chief towns, which is appended to the monthly report of vital statistics.

II. An abstract of the results for each month, compared with the averages for the same month in previous years, is published in the *Gazette* and circulated in a separate form to all correspondents. These abstracts are intended for the guidance of agriculturists and other persons who require to watch the peculiarities of each season closely.

III. Tabular abstracts, in the same form that has been followed since 1853, are prepared for the annual volume of statistics.

IV. A biennial report on the climate, embodying all the most interesting results, is published in octavo pamphlet form and largely circulated.

In addition to the above, daily telegraphic reports of the weather are obtained at 9 a.m. from twenty-five stations, and are exhibited for public information at all the shipping ports in the colony. Since

1874 this branch has been placed under the charge of a special signal officer, who issues warnings of the probable approach of storms to the different seaports.

The following tables embody the averages which have been ascertained for the different elements of the climate of New Zealand.

Temperature.

The climate resembles that of Great Britain, but is more equable, the extremes of daily temperature only varying throughout the year by an average of 20°, whilst London is 7° colder than the North and 4° colder than the South Island of New Zealand. The mean annual temperature of the North Island is 57°, and of the South Island 52, that of London and New York being 51°.

The mean annual temperature of the different seasons for the whole colony is, in spring 55°, in summer 63°, in autumn 57°, and in winter 48°.

Comparative Temperatures of New Zealand.

I. General Abstract.

Stations.	S. Lat.	Long. E. from Greenwich.	Number of years of Observation.	Year.	Winter.	Spring.	Summer.	Autumn.	Difference of the Coldest and Warmest Months	Yearly Means. Max.	Yearly Means. Min.	Yearly Fluctuation.
North Island.	° ′	° ′										
Mongonui ...	35 1	173 28	10	59·90	53·06	58·28	66·56	61·52	15·12	89·10	31·82	57·28
Auckland ...	36 50	174 51	20	59·54	52·34	57·56	66·92	61·16	16·02	88·52	33·26	55·26
Taranaki ...	39 4	174 5	14	57·56	50·90	55·94	64·58	58·82	15·66	86·90	30·02	56·88
Napier ...	39 29	176 55	10	57·56	49·10	57·74	66·20	57·02	19·26	90·00	32·10	59·90
Wellington ...	41 16	174 47	14	55·58	48·74	54·50	62·24	56·66	14·76	78·44	32·18	46·26
Wanganui ...	39 56	175 6	3	55·90	48·71	53·31	63·31	57·12	16·70	86·00	29·00	55·00
South Island.												
Nelson ...	41 16	173 19	11	54·86	46·58	54·50	62·78	55·76	17·10	82·04	27·32	54·72
Hokitika ...	42 42	170 59	10	52·34	45·50	51·62	59·18	53·06	14·76	74·12	28·22	45·90
Bealey* ...	43 2	171 31	9	46·76	37·40	46·04	54·86	48·56	18·18	78·08	12·38	65·70
Christchurch ...	42 33	172 39	12	52·88	43·52	53·24	61·52	53·60	18·72	88·16	25·16	63·00
Dunedin† ...	45 52	170 31	17	50·72	43·52	50·54	57·20	51·80	15·30	84·74	29·84	54·90
Invercargill ...	46 17	168 20	14	50·36	42·26	51·26	58·10	50·00	16·92	83·84	20·12	63·72
Queenstown‡ ...	45 2	165 39	3	51·01	40·01	50·92	64·02	52·31	21·25	84·60	23·21	61·39

* Height above sea, 2,104 feet. † Height above sea, 550 feet. ‡ Height above sea, 1,070.

II. Daily Range of Temperature.

Difference of the Mean Daily Extremes.

Stations.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Year
North Island.													
Mongonui ...	15·48	16·74	15·30	19·08	18·18	16·92	15·30	15·66	16·92	16·02	14·58	16·74	16·38
Auckland ...	18·90	19·80	20·88	19·80	19·08	16·92	15·30	15·48	16·74	15·84	16·56	18·00	17·82
Taranaki ...	19·62	21·60	20·16	21·42	19·44	15·84	15·30	14·40	16·56	18·00	16·74	18·54	18·18
Napier ...	18·72	21·60	21·78	17·82	15·12	14·94	13·86	15·30	15·12	18·00	18·18	19·08	17·46
Wellington ...	13·32	13·50	12·42	12·42	11·70	11·16	10·62	10·62	11·52	11·88	12·24	13·50	12·06
South Island.													
Nelson ...	20·34	23·40	20·70	21·24	17·10	17·82	19·08	19·08	19·62	21·06	21·42	22·14	20·16
Hokitika ...	11·34	11·16	13·32	12·60	12·78	13·86	14·58	13·68	14·76	15·66	12·24	11·52	13·14
Christchurch ...	17·10	18·36	16·56	17·46	17·10	16·38	14·94	16·56	16·02	16·20	18·54	19·08	17·10
Dunedin ...	16·20	15·66	15·66	15·12	13·68	11·52	10·44	10·62	12·06	13·32	13·68	15·30	13·68
Invercargill ...	22·50	21·78	22·50	22·68	18·00	16·02	17·64	16·92	19·44	22·32	21·06	21·06	20·16

Comparison between Climate on East and West Coasts.

The climate on the west coast of both Islands is more equable than on the east, the difference between the average summer and winter temperature being nearly four degrees greater on the south-east portion of the North Island, and seven degrees on that of the South Island, than on the north-west, on which the equatorial winds impinge. This constant wind is the most important feature in the meteorology of New Zealand, and is rendered more striking by comparing the annual fluctuation of temperature on the opposite seaboards of the South Island, which have a greater range of temperature by eighteen degrees at Christchurch on the east than at Hokitika on the west.

Rainfall.

I. Review of the Proportions of Rain in New Zealand.

Stations.	Rainfall.					Probability of Rain.					Mean Max. in 24 Hours.
	Winter.	Spring.	Summer.	Autumn.	Total for Year.	Winter.	Spring.	Summer.	Autumn.	Year.	
N. Island.	Percentage.				Inches.						
Mongonui ..	36	24	23	17	58·132	0·66	0·50	0·33	0·39	0·47	3·500
Auckland ..	32	25	19	24	47·008	0·61	0·52	0·33	0·41	0·47	3·358
Taranaki ..	29	27	20	23	59·442	0·52	0·51	0·35	0·38	0·44	2·520
Napier ..	39	15	35	11	36·004	0·26	0·22	0·24	0·17	0·22	..
Wellington ..	29	24	24	22	51·542	0·51	0·43	0·37	0·40	0·43	2·610
S. Island.											
Nelson ..	27	26	29	17	61·599	0·27	0·25	0·22	0·18	0·23	7·189
Hokitika ..	24	28	28	20	111·653	0·52	0·61	0·57	0·48	0·54	3·532
Bealey ..	22	28	31	18	105·340	0·53	0·61	0·56	0·47	0·54	3·512
Christchurch	31	21	25	23	25·536	0·36	0·33	0·28	0·24	0·30	1·622
Dunedin ..	23	23	28	26	31·682	0·51	0·55	0·58	0·54	0·54	2·079
Southland ..	26	23	26	26	49·732	0·47	0·47	0·40	0·49	0·46	1·130

II. Totals of Monthly Rainfall in Inches.

Stations.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.
N. Island.												
Mongonui ..	2·339	3·209	7·787	1·492	2·882	5·461	8·319	6·598	6·241	5·831	3·701	4·272
Auckland ..	3·409	2·071	3·272	3·150	3·402	4·771	5·721	5·279	4·331	4·331	3·520	3·752
Taranaki ..	4·921	3·221	3·908	2·579	3·520	7·720	5·914	6·299	5·177	5·252	5·969	4·858
Napier ..	5·630	3·571	3·650	1·130	1·358	1·532	3·402	3·681	6·870	2·414	1·539	1·201
Wellington ..	3·999	3·882	4·453	3·780	3·280	4·540	5·212	5·658	4·299	3·941	5·000	3·500
S. Island.												
Nelson ..	4·319	5·358	8·331	2·063	3·221	5·177	4·441	6·319	6·233	6·319	5·000	4·815
Hokitika ..	12·169	8·902	9·871	6·752	8·611	6·370	8·240	9·638	9·130	5·878	13·402	12·690
Bealey ..	14·087	9·681	8·902	3·921	7·433	8·079	5·019	10·378	7·799	5·811	15·501	8·733
Christchurch	1·622	2·311	2·370	1·752	1·811	2·280	3·189	2·449	2·319	1·161	2·142	2·130
Dunedin ..	3·012	3·599	2·142	2·220	2·122	3·949	2·441	2·500	2·228	2·000	2·500	2·969
Southland ..	3·622	5·279	3·921	3·980	3·571	5·401	5·019	3·441	4·390	2·661	3·929	4·520

The fluctuation in the annual rainfall at the principal stations is shown in the following table:—

RAINFALL.—1866 to 1884.

Stations.	Means for each Year, and Difference from General Average.						
North Island.	1866.	1867.	1868.	1869.	1870.	1871.	1872.
Auckland ..	42·000	53·180	49·087	52·797	44·831	47·505	42·096
	−3·306	+7·874	+3·781	+7·491	−·475	+2·199	−3·210
Taranaki ..	55·700	60·690	50·420	55·125	54·720	72·120	63·640
	−2·384	+2·606	−7·664	−2·959	−3·364	+14·036	+5·656
Napier	30·000	..	..	..	32·850	35·890	23·940
	−7·260	..	..	..	−4·410	−1·370	−13·320
Wellington ..	41·100	41·950	55·522	56·768	48·205	64·057	50·945
	−9·681	−8·831	+4·741	+5·987	−2·576	+13·276	+·164
South Island.							
Hokitika ..	127·500	110·510	120·210	88·210	116·680	122·440	123·210
	+15·344	−1·646	+8·054	−23·946	+4·524	+10·284	+11·054
Christchurch ..	19·400	30·070	30·041	27·292	28·364	27·935	19·741
	−6·374	+4·296	+4·267	+1·518	+2·590	+2·161	−6·033
Dunedin ..	29·000	39·050	33·893	32·918	39·202	22·146	27·393
	−3·019	+7·031	+1·874	+·899	+7·283	−9·873	−4·626
Southland ..	47·200	41·620	46·346	42·680	53·950	39·030	40·110
	+3·526	−2·054	+2·672	−·994	+10·276	−4·644	−3·564
North Island.	1873.	1874.	1875.	1876.	1877.	1878.	
Auckland	41·237	35·024	51·310	44·025	40·375	37·160	
	−4·069	−10·282	+6·004	−1·281	4·931	−8·146	
Taranaki	53·120	57·220	66·960	48·180	52·000	56·730	
	−4·964	−·864	+8·876	−9·924	−6·084	−1·354	
Napier	42·380	37.940	38·260	38·390	33·450	21·100	
	−5·120	+·680	+1·000	+1·130	−3·810	−16·160	
Wellington	54·985	53·496	65·827	43·374	51·925	54·602	
	+4·204	+2·715	+16·046	−7·401	+1·144	+3·821	
South Island.							
Hokitika	96·170	104·480	130·790	116·325	136·660	154·446	
	−5·986	−7·676	+18·634	+4·169	+24·504	+42·290	
Christchurch	26·330	22·790	32·310	23·990	23·720	13·540	
	+·556	−2·984	+6·536	−1·029	−2·054	−12·234	
Dunedin	35·825	28·739	42·631	38·260	37·460	45·295	
	+3·806	−3·280	+10·612	+5·586	+5·441	+13·216	
Southland	37·450	44·650	44·180	..	43·150	54·020	
	−6·194	+·976	+·506	..	−·524	+10·346	
North Island.	1879.	1880.	1881.	1882.	1883.	1884.	
Auckland	46·130	38·890	34·237	45·630	52·215	38·070	
	+·824	−6·416	−11·069	+·324	+6·909	−7·236	
Taranaki	60·180	47·220	..	..	..	..	
	−2·096	−10·864	..	..	..	..	
Napier	53·140	38·400	..	..	..	..	
	+15·880	+·140	..	..	..	..	
Wellington	57·441	46·767	50·132	55.685	51·994	62·335	
	+6·660	−4·014	−·649	+4·904	+1·213	+11.554	
South Island.							
Hokitika	128·295	122·840	..	..	..	..	
	+16·139	+10·684	..	..	..	..	
Christchurch	23·180	17·670	*28·071	25·391	30·336	28·451	
	−2·594	−8·104	+2·297	−·383	+4·562	+2.677	
Dunedin	42·099	33·063	26·402	41·796	38·312	33·881	
	+10·080	+1·044	−5·617	+9·777	+6·293	+1·862	
Southland	33·260	39·140	..	..	..	..	
	−10·414	−4·534	..	..	..	..	

* Station moved from Christchurch to Lincoln, Canterbury.

MEAN ANNUAL RAINFALL.

North Island.		*South Island.*	
Auckland	45·306	Hokitika	112·156
Taranaki	58·084	Christchurch	25·774
Napier	37·260	Dunedin	32·019
Wellington	50·781	Southland	43·674

The observations that have been taken show that the northern part of New Zealand is within the influence of the subtropical winter rainfall, the probability of rainfall in winter in that part of the colony being twice as large as in summer.

In the south, however, the rainfall, though irregular, is distributed more equally over the year. The chief difference to be observed is that on the west coast spring rains prevail, and summer rains on the east coast; while in the middle of the colony the driest season is autumn, and in the south it is the winter and spring.

The contrast between the rainfall on the east and west coasts, as with the temperature, is most striking. Thus, in the North Island, Napier on the east has only half the amount of rain that falls in Taranaki on the west. But the South Island, with its longitudinal range of lofty mountains, exhibits this feature in a still more marked manner, for the rainfall on the west is nearly five times greater than that on the east. The excess of precipitation on the coast is clearly illustrated by the distribution of the glaciers on the opposite sides of the range. Those on the west slope have an excessive supply of snow, and descend to a line where the mean annual temperature is 50° Fahr., while on the east slope they descend only to the mean annual temperature of 37°. The winter snow-line on the Southern Alps on the east side is 3,000ft., and that on the west side is 3,700ft.

The distribution of the rainfall in different parts of the Islands is best expressed by an approximate statement of the hydraulic discharge from the various drainage-areas. The average rainfall, and the percentage allowed for evaporation and soil-absorption, have been estimated for each area from such information as is available, but must only be accepted as provisional.

SCHEDULE of the PRINCIPAL RIVERS in NEW ZEALAND, showing approximately the AREAS of WATERSHEDS, the AVERAGE ANNUAL RAINFALL, and DISCHARGE for each.

Rivers.	Area.	Average Rainfall.	Estimated Discharge per Minute.	Remarks.
North Island.	Sq. Miles.	Inches.	Cubic Feet.	
Waikato	4,768	40	839,168	
Kaipara	2,622	47	545,376	
Wanganui	2,525	47	525,200	
Manawatu*	2,239	65	642,593	
Thames	1,779	48	377,148	Including Piako.

SCHEDULE of the PRINCIPAL RIVERS in NEW ZEALAND, &c.—*continued.*

Rivers.	Area.	Average Rainfall.	Estimated Discharge per Minute.	Remarks.
North Island—continued.	Sq. Miles.	Inches.	Cubic Feet.	
Rangitaiki	1,633	30	215,556	Have a common embouchure in a coastal lagoon.
Whakatane	1,014	35	156,156	
Rangitikei	1,435	50	315,700	
Wairoa*	1,303	45	257,994	
Mohaka	1,034	45	204,732	
Ngaruroro*	843	40	148,368	Might be concentrated on Napier Harbour.
Tutaekuri and Esk ..	487	35	73,998	
Tukituki	815	35	125,510	
Mokau	815	60	215,445	
Patea	622	55	151,146	
Waipaoa, Poverty Bay* ..	602	30	80,066	Partly combine in floods.
Gisborne	75	35	11,550	
Hokianga..	560	50	123,760	
Waiapu*	505	40	88,880	
Waitara	501	56	123,747	
South Island.				
Clutha*	8,248	30	1,088,736	
Waitaki*	4,730	26	539,220	
Waiau (South)	3,079	41	557,299	
Mataura*..	2,378	30	316,274	
Buller*	2,341	95	990,897	
Taieri*	2,317	37	379,988	
Grey*	1,572	90	624,084	
Wairau*	1,562	35	240,548	
Oreti	1,422	40	250,272	
Waimakariri*	1,922	55	345,546	
Rakaia*	1,401	50	308,220	
Rangitata*	752	48	159,424	
Selwyn (Lake Ellesmere) ..	718	30	94,776	
Jacob's	633	40	111,408	
Haast*	412	125	227,424	
Kaduka (Martin's Bay) ..	283	127	158,480	
Hokitika*	382	120	202,460	
Oamaru Creek	23	22	2,231	
Milford Lagoon and Opihi ..	888	28	109,224	

NOTE.—Rivers marked * have mountain sources not trapped by lakes, and are therefore subject to exceptional floods.

Periods of lasting drought are almost unknown in New Zealand, and only in two instances do the records show a whole month at any station without rain. The greatest day's rain recorded is 6½in. at Auckland, and 9½in. in Nelson. Similar heavy showers occur at the north-west stations, where the general average shows 70in. in eighty-five days in the year. The opposite extreme is on the south-east, where 34in. fell in 180 days.

PRESSURE OF AIR.

The mean atmospheric pressure in New Zealand between lat. 37° and 46° S. decreases from 29·981in. to 29·804in.; the average pres-

sure being for all stations 29·919. For the corresponding north latitudes the average pressure is 30·005, but in the New Zealand area the fluctuations are much greater, and, though frequent, are tolerably regular in their periods. The maximum pressure occurs in April, and the minimum in November. The extreme range of the barometer is a little over 2in., and the average daily range from hourly observations is ·043in.

The following are the observed averages of pressure for a few of the principal stations :—

I. Monthly Range of Air Pressure.

Stations.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Year.
Auckland ...	0·657	0·681	0·728	0·756	0·909	0·961	1·043	1·051	0·965	0·886	0·827	0·835	1·417
Taranaki ...	0·740	0·883	0·886	0·984	1·028	0·917	1·094	1·138	1·024	1·051	0·929	0·752	1·594
Southland ...	1·193	1·122	0·854	1·039	1·079	1·240	1·256	1·248	1·197	1·094	1·240	1·169	1·732

II. Daily Amplitude.

Dec.	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.
0·038	0·034	0·038	0·044	0·050	0·046	0·041	0·048	0·044	0·050	0·042	0·042

III. Hourly Fluctuation of Atmospheric Pressure and Elastic Force of Vapour.

A.M.

—	Mid-night.	1	2	3	4	5	6	7	8	9	10	11
Bar. ..	+ ·013	− ·001	− ·008	− ·012	− ·010	+ ·004	− ·006	− ·006	− ·005	− ·008	− ·001	− ·011
El. Force	− ·021	− ·017	− ·011	− ·017	− ·011	− ·014	− ·006	− ·003	+ ·010	+ ·008	+ ·011	+ ·018

P.M.

—	Noon.	1	2	3	4	5	6	7	8	9	10	11
Bar. ..	− ·012	− ·012	− ·016	− ·010	− ·008	− ·003	+ ·007	+ ·019	+ ·025	+ ·021	+ ·020	+ ·019
El. Force	+ ·020	+ ·025	+ ·021	+ ·013	+ ·008	+ ·009	+ ·003	− ·002	− ·006	− ·006	− ·007	− ·011

Winds.

Owing to the fact that most atmospheric disturbances pass from west to east, with the centres of the depression to the south of New Zealand, there is a marked prevalence of westerly winds throughout all seasons, but they are much modified by the form of the land. When the centres pass to the north of New Zealand the result is that north-east winds impinge on the east coast, bringing rain, followed by

cold south-easters, with heavy storms of rain and snow during winter in the south.

The more common westerly winds begin in the north-north-west, with heavy rain on the west coast, and gradually veer to south-west, when fair bright weather sets in on that coast; but the same southerly wind, sweeping along the east side of the Islands, brings heavy strong weather locally known as "southerly bursters," which, from the shape of the coast, reach the region of Cook Strait as south-east storms. All the other winds are either land or sea draughts, with fine light weather; or are moderate winds produced by the circulation of the atmosphere round anticyclonic areas of high barometric pressure, that are far more persistent in their influence than the fast-moving cyclonic or low-pressure areas.

Thunderstorms.

Thunderstorms are most frequent in the districts where the changes of wind are most suddenly felt, from the moist equatorial currents or the cold polar currents of the south-west.

They are most frequent in spring on the west coast, except in the extreme south-west of Otago, where during winter thunderstorms are of almost daily occurrence.

There being no westerly station on that part of the coast, this does not appear in the following abstract :—

Average Frequency of Thunderstorms.

—	Mongonui.	Auckland.	Taranaki.	Hokitika.	Bealey.	Christchurch.	Dunedin.	Southland.
Winter	4·0	1·0	2·0	3·0	2·3	0·6	0·8	6·0
Spring	7·7	3·0	7·2	5·5	7·0	0·4	3·2	6·0
Summer	6·0	10·0	5·5	4·0	6·2	1·0	2·7	11·0
Autumn	0·5	4·0	2·0	2·0	1·8	1·0	0·5	6·5
Year	18·2	18·0	16·7	14·5	17·3	3·0	7·2	29·5

Black-bulb and Radiation Thermometers.

The difference in the amount of cloud in the atmosphere is best illustrated by a reference to the average readings of black-bulb and radiation thermometers, for which comparison certain observations from the stations on the opposite sea coasts of the Southern Alps have been tabulated; but the extreme readings of the black-bulb

thermometer, especially at the southern stations, are very remarkable, as they frequently reach to 175° Fahr.

	Christchurch, East Coast, 42° 38′ S.L.			Hokitika, West Coast, 42° 42′ S.L.		
	Insolation.	Radiation.	Difference.	Insolation.	Radiation.	Difference.
Summer	131·72	44·78	86·94	84·02	48·38	35·64
Autumn	111·92	37·94	73·98	73·04	41·72	31·32
Winter	91·22	28·04	63·18	61·70	33·44	28·26
Spring	124·52	34·34	90·18	75·02	39·56	35·46
Extremes	158·00	14·54	143·46	97·34	21·92	75·42

STATISTICS.

The Colony of New Zealand was founded in 1839. Since that period the census has been taken nine times. While seven years elapsed between the first and second census, the succeeding enumerations were taken at intervals of about three years.

As the next census will be taken on the 28th March, 1886, it has not been deemed advisable to incur the expense of printing the detailed tables of the results of the 1881 census in this edition. On the 3rd April, 1881, the population of the colony amounted to 489,933 persons, of whom 269,605 were males and 220,328 females. The total population in 1871 amounted to 266,986 persons, the increase since then having been 83·51 per cent. In the above number the military and their families have not been included as they did not constitute a portion of the settled population of the colony, and have now been all removed.

Nationalities.

The nationalities composing the above population on the 3rd April, 1881, were as follow :—

English and Welsh	121,187
Scotch	52,753
Irish	49,363
Australian	17,277
New-Zealand-born (white)	223,404
Other British possessions	5,339
Foreign	19,777
Uncertain	833
	489,933

Proportion between the Sexes

In March, 1878, there were 79·40 females to every 100 males, but in that proportion the Chinese people were included, and as they do not come to the colony with a view to permanent settlement, and do not bring their women with them, a juster estimate of the general population would be made by estimating the proportion exclusive of the Chinese. The proportion thus arrived at would be 100 males to 80·98 females.

In April, 1881, there were 100 males to 81·72 females, and excluding Chinese the proportions were 100 males to 82·88 females, showing a marked movement towards the numerical equalization of the sexes.

Number of Chinese.

The number of Chinese in April, 1881, amounted to 5,033, of whom 16 were females.

Density of Population.

The population of the colony, exclusive of Maoris, amounted in April, 1881, to 4·693 persons to a square mile; but, as 187,439 persons resided in towns, the population outside the towns, numbering 302,494, only amounted to 2·89 persons to a square mile.

The progress made in the settlement of the colony under the influence of the Public Works system is shown by the density of the population to a square mile in 1871 and 1881. This was as follows :—

	Persons to a square mile.
1871	2·456
1881	4·693

The relative advance in the different provincial districts for the same period is seen by a comparison of the two following tables :—

	Persons to a Square Mile in 1871.		Persons to a Square Mile in 1881.
Canterbury ...	3·446	Canterbury ...	8·259
Westland ...	3·227	Wellington ...	5·611
Otago ...	2·773	Otago ...	5·350
Auckland ...	2·347	Taranaki ...	4·152
Wellington ...	2·194	Hawke's Bay ...	3·768
Nelson ...	2·057	Auckland ...	3·744
Hawke's Bay ...	1·315	Westland ...	3·154
Marlborough ...	1·309	Nelson ...	2·384
Taranaki ...	1·252	Marlborough ...	2·325

The average number of persons to an inhabited dwelling throughout the colony was 5·12 in 1881, against 5·02 in 1878, 4·88 in 1874, 4·48 in 1871, and 4·05 in 1867. But, while the average number of persons to each dwelling was on the increase, the average character of the dwellings was evidently improving, and their capacity for occupation by a larger number of persons becoming greater.

The population of the four principal cities, including suburbs, of the colony, was estimated as follows: On the 30th September, 1885, Auckland, 37,551; Wellington, 23,152; Christchurch, 33,293; Dunedin, 47,550.

Maori Population.

The total number of Maoris was in 1878 estimated at 42,814, the greater number being in the North Island, only a few living in the South and its adjacent islands. In 1881 the census returns gave 44,097 as the total number.

The number of the principal tribes is twenty: of these, the Ngapuhi is the strongest; the Waikatos rank next in point of numbers; the Ngatikahungunu is third; then the Ngatiporou and the Arawas. Of the Maoris in the colony, 24,368 were stated to be males, and 19,729 to be females.

As much difference of opinion has existed as to whether the numerical decline of the Maori race has not been, at any rate in certain districts, arrested, it may be interesting to compare, so far as they are given, the ages of the Maoris with the ages of the settled and steadily increasing population of England. The numbers and sexes of some of the Maori tribes have been imperfectly given. It is therefore necessary to deal only with those tribes for which full information as to numbers, ages, and sexes is given. This was the case in respect of the numbers belonging to thirteen of the principal tribes, amounting in the whole to 31,645, according to an account taken in the year 1874. Of these, 6,079 were males under fifteen, and 5,225 were females under fifteen. The males over fifteen amounted to 11,209, and the females over fifteen to 9,132. There was a total excess of males over females of 2,931, or to every 100 males there were 83·05 females. In England, in 1871, the males under fifteen amounted to 37·15 per cent. of the whole male population; the Maori males, of the tribes given, in 1881, under the age of fifteen, amounted to 33·78 per cent. of the whole male population of those tribes. The females of similar ages were, respectively, in England 35·13 per cent. of the whole female population, and among the Maoris 34·15 per cent. If the numbers of the males and females

under fifteen be respectively compared, the following result is shown :—

Proportions per Cent. to the whole Population.

Age.	England.	N.Z. European.	Maoris.
Males under fifteen ...	18·09	21·61	18·43
Females under fifteen...	18·03	21·24	15·35

To draw any conclusion from these figures, it would be necessary to have more exact information as to the numbers of the Maoris living at the various higher age-periods, but the information has only been given for the periods under and over fifteen.

The existence among some tribes of the Maoris of a higher proportion of females under fifteen (ultimately to become wives and mothers) to the total female population than obtains in England, the percentage under fifteen to the total females being respectively 40·03 in the Ngapuhi, 41·12 in the Arawa, and 46·15 in the Urewera, while it is only 35·13 per cent. in England), might at first sight lead to the belief that the decline in the numbers of the race had been arrested, and that even an increase might be expected. This is not the case, however, as there are causes in operation which increase the mortality of the adult Maoris without increasing the mortality of the children, so that the actual proportion of children to the whole population would be thereby much greater, and an appearance of productiveness shown which did not really exist.

Do such causes exist? Does the fact of the partial adoption by the adult Maori of civilized habits and costume, and the continual reversion to the habits and costume of barbarism, with a system rendered more susceptible to external influences, especially those of a humid and changeable climate, tend to promote the spread of disease, notably of tubercular diseases, and consequent mortality? Does the spread of drinking habits tend to shorten the life of the adult Maori? These and other similar questions have an important bearing on the subject.

The examination of the numbers of some of the tribes points rather to the conclusion that some such causes of mortality among the adults do exist. In the return for a former year the Ngatikahungunu show 41·91 per cent. of the males and 41·21 per cent. of the females as being under fifteen years of age. The Arawa show 40·58 per cent. of the males and 48·30 per cent. of the females as being under fifteen.

It is hardly conceivable that the women of these tribes should have been so exceedingly prolific, and that, as in the case of the Arawa, nearly one-half of the female population should have been

under fifteen, unless a large number of adult women had died before reaching middle age, thereby increasing the proportion of younger females by reducing the proportion of the adults.

It may be noticed in connection with this subject that in 1871 the Maoris were estimated at 37,502, and in 1867 at 38,540; while in 1874 they were estimated at 45,470, in 1878 at 42,819, and in 1881 at 44,097. The estimates formerly made were, however, from the then state of feeling iu the Maori population, necessarily much more imperfect and unreliable than those recently made.

Occupations of the Chinese.

The Chinese at the census of 1881 numbered 5,033, of whom sixteen were women. As special legislation has taken place with regard to them, the following statistics are given of their principal occupations:—

Gold-miners	3,858
Farmers or market-gardeners	298
Farm servants and labourers	60
Gardeners...	95
Rabbiters...	53
Cooks	56
Servants	56
Shopkeepers	85
Hawkers	33
Labourers...	133
Inmates of charitable institutions ...	18
Prisoner	1
Various occupations	347
	5,033

Vital Statistics.

The estimated population of the colony on the 30th September, 1885, amounted to 576,234. These figures do not include the aboriginal natives, who numbered about 44,097, at the last census in 1881. If that number be added to the rest of the population, there would thus be given a total of 620,331 inhabitants at that date.

Birth-rate.

The children born alive and registered in 1884 amounted to 19,846, or at the rate of 35·91 per 1,000 of the population. This is

the lowest rate for the whole colony yet recorded. The average birth-rate in England for the ten years 1868–77 was 35·7 per 1,000, and in 1882 it was 33·7 per 1,000. As in the English population the females are more numerous than the males, while in New Zealand the males are largely in excess of the females; to compare the birth-rate in the colony with the birth-rate in England the rate should rather be estimated on a total population of which the males do not exceed the females. Deducting from the population the surplus males, the birth-rate in New Zealand would have been at the rate of 38·5 per 1,000 of equal males and females.

Marriage-rate.

The marriages in 1884 numbered 3,800, the number of persons married being at the rate of 13·74 per 1,000 of the population. This is somewhat lower than the average rate in England for the decade 1868–77, which was 16·6.

Death-rate.

The death-rate in 1884 amounted to 10·39 per 1,000 of the population. The death-rate in England for 1878 was 23·8, the average rate for the ten years ending 1877 being 21·9.

FINANCE.

Revenue.

The Customs revenue in 1885 amounted to £1,428,809, against £1,413,393 in 1884, being an increase of £15,416, or 1·09 per cent.

The total ordinary revenue for the colony in 1884 was as under:—

Ordinary revenue, raised by taxation	£3,280,115
Territorial revenue, not raised by taxation	427,373
Total revenue	£3,707,488

This shows a decrease of £190,076 in the ordinary revenue, and an increase of £26,297 in the territorial revenue, as compared with 1883.

Expenditure.

The ordinary general expenditure, or expenditure chargeable on general revenue, for 1884 was £4,101,318, being an increase on the similar expenditure in 1883 of £177,313. This does not include special expenditure out of loans.

Public Debt.

The total public debt of the colony on the 31st December, 1884,

amounted to £32,860,982; the total annual charge upon which was £1,570,403, part of this sum, namely, £119,052, being a payment to the sinking fund. The amount to the accrued sinking fund, at the same date, was £2,983,403.

The estimated mean population for the year 1884 was 564,304. This is inclusive of about 5,000 Chinese, but exclusive of 44,097 Maoris. The latter contribute largely to the revenue through the Customs, and many of them are wealthy. For the present purpose, therefore, they may very properly be included in the general total, which thus amounted to 608,401. These data give a total debt of £54 per head, and an annual charge of £2 12s. 9d. per head of population; but the amount of the accrued sinking fund, £2,983,403, in reality reduced the public debt to £29,877,579, and therefore the rate per head is proportionately lessened to £49 2s. 4d. per head. It has, however, been very justly remarked that the pressure of a public debt on a community is not to be estimated by the simple process of counting heads, but that it is to be more correctly ascertained by inquiry into the earnings and conditions of the population. Consideration must also be given to the fact that a large proportion of the debt of New Zealand exists in the form of reproductive works already, in some instances, returning a fair interest on the outlay.

Accumulation.

Banks.

The total average liabilities of the banks within the colony during 1884 amounted to £10,691,599; the total assets to £18,442,139; the total paid-up capital on the 31st December, 1884, to £5,850,000; the total amount of last dividends to £419,000; and the total amount of reserve funds, at the time of declaring such dividends, to £3,295,058.

Savings-Banks.

The figures given below show the operations of the Post-Office Savings-Banks for the last six calendar years. The severe depression which existed throughout the colony during 1879 appears to have had comparatively little effect upon this business. A greater amount of money was withdrawn during the year, but the total amount left standing at the credit of depositors on the 31st December, 1879, was very little less than in 1878, and greater than in 1877; and since

that time there has been a steady increase, as the following table shows :—

—	1879.	1880.	1881.	1882.	1883.	1884.
	£	£	£	£	£	£
Amount of deposits ..	812,399	864,441	1,189,012	1,325,852	1,178,474	1,227,909
,, withdrawals	876,180	780,504	902,195	1,142,599	1,295,719	1,195,921
,, at credit of depositors	787,006	903,765	1,232,787	1,470,950	1,409,751	1,499,112
Average amount at credit of each depositor	22 12s. 11d.	23 7s. 6d.	24 3s. 4d.	25 11s. 5d.	22 15s. 2d.	22 16s. 3d.
Number of Post-Office Savings-Banks	165	178	190	207	222	243

The average cost of each Post-Office Savings-Bank transaction, deposit or withdrawal, in the year 1884 was $4\frac{7}{8}$d.; the average for the whole period of the existence of the Post-Office Savings-Banks in the colony being 6d. The proportion of depositors to the population was 1 to 13 for 1878, while in 1881 it had risen to 1 in 10 and in 1884 to 1 in 8. The proportion in the United Kingdom, in 1877, was 1 in 19.

On the 31st December, 1884, the total sum standing at credit of depositors in the Post-Office Savings-Banks amounted to £1,499,112
At the credit of depositors of other savings-banks ... £427,646

£1,926,758

This amount is equal to £3 6s. 0d. per head of the European population at the same date, as against £2 11s. 7d. for 1878 and £3 1s. 10d. for 1881.

These figures are valuable, as giving an indication of the prosperity of the working classes; but there is a very large amount of savings constantly being invested in building societies, and as constantly being withdrawn for the purchase or erection of dwellings, of which no official record exists.

In No. IV. of the statistical diagrams at the end of this book will be found an interesting representation of the fluctuations in the rate of savings in New Zealand.

Trade.

The rapid growth of the import and export trade of New Zealand from the date of the establishment of the colony to 1884 inclusive will be seen from the following remarks :—

For the four years preceding 1845, the average value of the trade was: Imports, £139,000; exports (the produce of the colony), £33,000. For the ten years following: Imports, £407,875; exports, £171,875. For the period 1856-65: Imports, £3,270,000;

exports, £1,578,000. 1866-75: Imports, £5,767,500; exports, £4,805,500. 1876-84: Imports, £7,652,722; exports, £6,287,128. The imports for the year 1885 amounted to £7,479,921, and the exports (of local production) to £6,819,939.

The great bound shown in the figures for the period 1856-65 was caused by the gold discoveries. The first considerable exportation of this metal took place in 1861, the value being £752,657, increasing in the following year to £1,591,389, and the year subsequent (1863) to £2,431,723. A more than corresponding large increase in the imports took place in the same period, due to the great influx of miners and immigrants from all parts of the world.

The total import and export trade of the colony for the year 1884, in proportion to population, amounted to £26 14s. 0½d. per head of the mean population (excluding Maoris), being a decrease on 1883 of £1 15s. 4½d. per head.

Trade with Different Countries.

A comparison of the total value of imports in 1883 and 1884 according to the countries whence they were received, gives the following results:—

United Kingdom, decrease	...	£307,354 or	5·9 per cent.
Australian Colonies, increase	...	59,579 or	3·8 per cent.
Other British Possessions, decrease		97,806 or	18·0 per cent.
United States, decrease	...	70,693 or	16·9 per cent.
Other countries, increase	...	105,914 or	53·0 per cent.

A similar comparison as regards the exports for 1883 and 1884 results as follows:—

United Kingdom, decrease	...	£188,815 or	3·5 per cent.
Australian Colonies, increase	...	481,711 or	43·4 per cent.
Other British Possessions, decrease		24,819 or	25·8 per cent.
United States, decrease	...	216,620 or	50·3 per cent.
Other countries ...	...	55,798 or	49·7 per cent.

It will be observed that the exports to the Australian Colonies show a considerable increase. The principal shares in this increase fell to New South Wales with £207,751, and Victoria with £268,337. Gold was exported in 1884 to New South Wales to the value of £138,674, and to Victoria of £560,390.

The very slight increase in the imports from the Australian Colonies is accounted for by a falling-off of £124,302 in the imports from Victoria, and of £26,931 in the imports from Tasmania. The imports from New South Wales, Queensland, and Western Australia,

however, show an increase of £173,591, £22,382, and £12,558 respectively, which more than counterbalances the deficiency.

The large increase of 53 per cent. in the imports from "Other Countries" is more than accounted for by the fact that, in 1884, £138,899 worth of merchandize, principally raw sugar for the Auckland Refinery, was imported from Java, the imports from that country in 1883 having been nil.

A new export, which has taken a very high place since its commencement four years ago, is that of frozen meat, principally mutton. In the first year of the trade, 1882, 15,244cwt., valued at £19,339, were sent to London; in 1883, 87,975cwt., valued at £118,328, and in 1884, 254,069cwt., valued at £345,090. The following extracts from an interesting address delivered by Mr. J. S. M. Thompson, Chairman of Directors, at the annual meeting of the Gear Meat Freezing and Preserving Company (Limited), of Wellington, afford some valuable information with regard to the frozen meat trade. For the year ending the 31st October, 1883, the export of tallow amounted to 22,093 casks; for 1884 to 22,022 casks, and in 1885 to 18,870 casks; the decrease showing that boiling down was being superseded by freezing. The quantity of frozen sheep shipped during the three years ended on the 31st October, 1885, was: 1883, 126,365 carcases; 1884, 408,346 carcases; 1885, 489,554 carcases. The low prices realized lately in the London market have been somewhat discouraging, but quite recently the price has advanced to 5½d. per lb. Mr. Thompson stated that the prices per lb. for New Zealand frozen mutton in London had been as follow for six months in each of the three years:—

Year.	June.	July.	August.	September.	October.	November.
New Zealand Mutton.						
1883	7½d.	6½d.	6d.	6d.	5⅝d.	5½d.
1884	5d.	4⅝d.	4½d.	5d.	6½d.	5½d.
1885	5½d.	4⅝d.	4½d.	4½d.	4⅜d.	4d.
English Mutton.						
1885	7½d.	6½d.	6½d.	5⅝d.	5½d.	5½d.

In June, 1885, the difference in price between English and New Zealand mutton was 2d., whilst in November there was only a difference of 1½d. per lb.

Shipping.

The configuration of the colony, and the difficulty of traversing a country with few roads, early caused a considerable costal traffic to be developed.

In December, 1884, there were 583 vessels on the New Zealand register, having an aggregate tonnage of 92,696 tons.

The total shipping inwards for 1885 was ... 519,700 tons.
„ „ outwards „ „ ... 513,000 „

Regular and frequent steam traffic exists between all the principal ports of the North and South Islands, and also between the colony and the Australian ports of Melbourne and Sydney. The ever-increasing requirements of the coastal and intercolonial traffic have been fully met, chiefly through the exertions and energetic enterprise of a local establishment, the Union Steamship Company of New Zealand. Almost daily communication is now maintained between the large centres of population in the South Island and the capital; and, by means of new and very powerful steamers belonging to the company, the passage between Wellington and Lyttelton, the connecting link, so to speak, between the railway systems of the two Islands, is practically reduced to a matter of some twelve or thirteen hours. This is a less time, by about four hours, than would be occupied by proceeding overland, supposing the present Canterbury line of railway continued to Picton, and a quick ferry established across Cook Strait between that port and Wellington.

There is also monthly communication with San Francisco by a subsidized line of mail steamers under the management of the Union Company.

Direct Steam Service.

Since the issue of the last edition of the "Handbook," two magnificent lines of ocean steamers have been started from London to New Zealand. The New Zealand Shipping Company, which was first in the field, is under contract with the New Zealand Government for carrying Her Majesty's mails. Both the New Zealand Shipping Company's and Shaw, Savill, and Albion Company's steamers have frequently made the voyage in less than 40 days.

Manufactories, Works, etc.

Unstimulated by the questionable aid to be derived from so-called protective duties, the manufactories and industrial works of New Zealand yet exhibit unmistakable progress; their total number in 1881 being 1,643, against 1,271 in 1878. This increase is almost entirely due to an extension in the number of industries dependent on the natural resources of the country, or incidental to a rapidly increasing population, and would seem to indicate a hardy and natural growth. Thus, since 1878 fellmongery, tanning, and currying establishments

increased from 100 to 119; boiling-down and meat-preserving works, from 32 to 40; saw-mills, from 201 to 223; iron foundries, from 29 to 35; agricultural-implement factories, from 8 to 23; furniture factories, from 12 to 45; sail factories, from 1 to 13; bacon- and fish-curing factories, from 8 to 34. The increase in the number of woollen mills from 3 in 1878 to 4 in 1881 is small, but the increased quantity of goods manufactured is really much larger than the small increase in the number of establishments would appear to indicate, and from occupying an almost experimental position the woollen manufactures have grown into a sure and flourishing industry. This may be the better realized when it is stated that, while in 1878 the number of hands employed was 78, it had risen in 1881 to 417.

The number of manufactories devoted to articles of clothing increased from 7 in 1874 to 24 in 1878 and 54 in 1881.

There were 54 companies registered in 1884 under "The Companies Act, 1882." Twelve of these are noticeable as bearing upon the development of local industries, and are as follow:—

	Number of Companies.	Nominal Capital.
Dairy produce and bacon factories ...	7 ...	£17,500
Tobacco growing and manufacturing company	1 ...	20,000
Candle and soap manufacturing companies	2 ...	52,000
Copper mining companies ...	2 ...	65,750

CROWN LANDS.

The total area of New Zealand is upwards of sixty-six million acres. Of this, eighteen millions have been sold, or disposed of in education and other public reserves; fourteen millions belong to the aborigines, or to the Europeans who have purchased from them; and thirty-four million acres of Crown lands still remain for disposal. Of the latter fifteen millions are open grass or fern country, ten millions forest, and nine millions are barren mountain-tops, lakes, and worthless country.

The Crown lands are administered under the authority of "The Land Act, 1885," by the Hon. the Minister of Lands, Wellington. The colony is divided into ten land districts, each being locally governed by a Commissioner and a Board. It is with the Land Offices the selector has to transact all business.

The names of the land districts and the fullest information concerning the disposal of Crown land will be found in the various publications of the Crown Lands Department.*

For convenience of reference, the following abstract of the various provisions for the settlement of the land has been taken from these publications :—

Crown lands are divided into three classes—

(1.) Town and village lands.

(2.) Suburban land—being land in the vicinity of any town lands.

(3.) Rural land—being lands not reserved for towns or villages or other public purposes.

Acquirement of Freehold for Cash.

The manner of acquiring the freehold of Crown lands is either at auction or by application :—

1. *At Auction.*—The land is previously surveyed and marked off on the ground into sections. Maps showing the sections are on view at the Land Office, and particulars are advertised at least a month before auction. The land is sold to the highest bidder above the upset price, the terms being an immediate payment of one-fourth the purchase-money, and the remainder within one month.

2. *By Application or Free Selection.*—A form, filled in, and signed the applicant or his agent, is left at the Land Office for consideration of the Land Board. One-fourth of the purchase-money is paid on application, and the balance within one month after the applicant has been declared the purchaser. In Canterbury there is no deposit on application, but immediately on the Land Board approving of the application the whole of the purchase-money must be paid.

Price of Land.

Town and suburban lands are sold by auction. Town sections are usually one quarter-acre each, having a frontage of 66ft. to a street, and running back 165ft. The minimum upset price is £7 10s. per quarter-acre section.

Suburban lands are sections of two to twenty acres, and the minimum upset price is £3 per acre.

Village lands, in sections under one acre, are offered *on application* at not less than £5 per section. If two or more persons apply on the same day for the same section, an auction is held confined to the applicants.

* See "Land Act, 1885," with explanatory preface, published by the authority of the Hon. J. Ballance, Minister of Lands.

Village lands, in sections between one and fifty acres, are designated "small-farm allotments," and in the case of more than one applicant for the same section its occupancy is determined by lot. The price of small-farm allotments is not less than £1 per acre. Small-farm allotments may also be had on perpetual lease, without a purchasing clause.

Rural lands comprise all other crown lands, whether agricultural, pastoral, or forest. The price varies from the mere cost of survey, under the homestead system, up to £2 per acre in Canterbury. The system of dealing with rural lands varies considerably in the different land districts.

Acquirement of Freehold on Deferred Payments.

The principal features of the deferred-payment system are—

(1.) If suburban land, an allotment must not exceed 20 acres; if rural agricultural land, 320 acres.

(2.) A selector of village or suburban land may make a subsequent selection of rural land, provided the total area does not exceed 320 acres, and any person who has for two years fulfilled all the conditions under which he took up his section can acquire further sections, provided he does not become the selector in the whole of more than 320 acres.

(3.) The price per acre of suburban land is £4 10s.; of rural land not less than £1; except in Auckland, Hawke's Bay, and Nelson, where the price may be less.

(4.) Suburban and rural lands are open for application, but if two or more persons apply for the same allotment it is put up to public tender, and in the event of two or more tenders being of the same amount the successful tenderer is decided by lot.

The deferred payments are made in equal instalments in advance, every six months.

For suburban land the period for payment is five years: therefore there are ten instalments.

For rural land the period for payment is ten years, making twenty instalments: thus, if land offered at £1 per acre was applied for by A and B, and went to auction, and A closed the bids at £1 10s. per acre, he would have 1s. 6d. per acre to pay every six months for ten years.

Any selector who has complied with the conditions of his purchase for a period of one year may have the value of the unpaid instalments

capitalized at the value of an annuity of the same amount and for the same period. Interest is payable at 5 per cent. per annum, instead of the half-yearly instalments. After the capitalized value is ascertained, he may pay off the whole sum, or any portion, in sums of not less than £10. At any time within fourteen years of the date of his license the selector is entitled to a Crown grant, if he has paid the whole of the capital value, together with interest; or he may exchange the deferred-payment license for a perpetual lease, in which case all past payments go to credit of rent.

On suburban land residence must begin within six months of issue of license, and continue for four years; and on rural land the period of residence required is six years.

Where land is wholly or mostly covered with bush, residence may be dispensed with altogether.

Improvement Conditions under the Deferred-Payment System.

Suburban.—Must bring into cultivation not less than a tenth of the allotment the first year, one fifth the second year, and within four years must have three-fourths cultivated, the whole fenced, and have made substantial improvements to the value of at least £10 per acre.

Rural.—If open land, one-twentieth must be brought into cultivation the first year, one-tenth the second year, and within six years one-fifth must be cultivated and permanent improvements effected to the value of £1 per acre.

The purchaser of rural land may, at any time after the first six years, pay the balance of the purchase-money if he has effected the improvements. He is then entitled to the Crown grant of the land.

The term "substantial improvements of a permanent character" includes reclamation from swamps, clearing bush or scrub, cultivation, planting with trees or hedges, laying out gardens, fencing, draining, making roads, sinking wells or water-tanks, constructing water-races, in any way improving the character or fertility of the soil, or the erection of any building. This definition applies to all classes of land where improvements are required as part of the contract.

LEASES OF SMALL AREAS.

Areas not exceeding 50 acres may be set apart for lease, with perpetual right of renewal. The land is offered at a fair fixed rent for the first period of thirty years, and if two or more persons should apply for the same piece of land the tenancy is decided by lot. In renewals of leases or transfers, full values for improvements are

allowed. The perpetual-lease system gives the tenant fair rent, fixity of tenure, and free sale of his interest in the lease and improvements.

Homestead System.

This was formerly in force in the Auckland and Westland Districts only. It now applies to the whole colony, provided no greater area than three thousand acres in one land district shall be set aside in one year. The settler makes no payment for the land, the only cost being that of survey. On the fulfilment of conditions—viz., five years' residence, the erection of a house, and the cultivation of one-third of the selection if open land, and one-fifth if bush land—the Crown grant is issued. Any person of the age of eighteen years or upwards may select from 75 to 50 acres, according to quality of land, and any person under eighteen years of age 30 to 20 acres, provided that no family or household shall have more than 200 acres of first-class or 300 acres of second-class lands. In Westland the conditions are the same, with the exception that 50, 20, and 200 acres are the limits as above, irrespective of quality of land.

Pastoral Runs.

These are put up to auction, at an upset rent, not less than a year before the existing licenses or leases expire. No more land than is sufficient to carry twenty thousand sheep or five thousand head of cattle can be offered in one lot.

Pastoral lands are let, subject to the license being revoked on a year's notice being given that the land is required for sale or lease as agricultural or pastoral land. The licensee is not entitled to any compensation for revocation of his license. The licensee may select a homestead area of 150 acres, which cannot be resumed during the currency of his lease.

If a licensee does not re-acquire the license for his run when it is submitted to auction, he is entitled to compensation for improvements of necessary buildings, plantations, fences, and ditches for draining, provided that the compensation does not exceed three times the average annual rent paid under the existing lease or license. No claim for compensation can be made against the Crown or any Land Board.

Leases or licenses of pastoral lands may not exceed twenty-one years, and there is no restriction as to the number of leases anyone may hold.

Small Grazing Runs.

The essential features in this system are—absolute lease for twenty-one years, without any right of determination on the part of the Government; full valuation for improvements at the end of the lease; the right to cultivate the land in addition to the exclusive right of pasturage; no right of purchase of any part of the land in the lease, but the right to select a hundred and fifty acres around the homestead, through which no road can be taken or other public privilege exercised without payment of compensation to the lessee.

Runs not exceeding in area five thousand acres each may be put aside for grazing purposes, and let by public auction, on the following conditions:—

(1.) The lease shall be absolutely for twenty-one years, with the first offer at the end of that term of a renewal for a second term of twenty-one years. If the offer is refused, the lease is put up to auction, burdened with the valuation for improvements, which have to be paid by the incoming tenant to the Receiver of Land Revenue, and by him to the outgoing tenant when the transfer of occupancy of the run has been satisfactorily accomplished. In any case, where it is determined that the run shall not again be offered for further lease, the outgoing tenant shall be paid the value of his improvements by the Government.

(2.) The lowest upset rent in the Land Districts of Auckland and Hawke's Bay will be 1½d. per acre; in Nelson and Marlborough, 3d.; in Taranaki, Wellingtan, Otago, Southland, and Westland, 6d.; and in Canterbury, 1s.

(3.) No person will be allowed to lease more than one small run.

(4.) Residence on the run is compulsory within twelve months of the commencement of the lease, and thereafter for six years, unless the lessee resides on land in his occupation within ten miles of the run leased by him.

(5.) Improvements have to be effected equal in value to four years' rental by the end of the first six years of the lease, the only condition for the remainder of the term being payment of rent.

Leasing of Crown Lands with Perpetual Right of Renewal.

The main features of the scheme are as follow:—

The Governor in Council may set apart for leasing one-third of the agricultural land open for sale.

Leases are sold to the highest tenderer at or above an upset rental of five per cent. on the capital value of the land as fixed by the Board. Thus, land valued at £1 per acre is put up at a rental of 1s. per acre per annum. Six months' rent, together with £1 10s. for the lease, has to be deposited with every tender. If two or more tenderers offer the same rent, and there is no higher offer, it is decided by lot which person shall be the lessee.

If a lease is not executed within a certain time the deposits are forfeited, and the next highest tenderer may be declared the lessee. If no tenders are received, any person may apply to lease the land for which tenders have been invited. Any person may tender for two or more leases, but cannot become the lessee under more than one lease, unless the lands adjoin each other. A tenderer for more than one lease need only deposit half-a-year's rent of the tender largest in amount. Any person of the age of seventeen years may become a lessee.

Limit of Area for each Lessee.

No person who owns the freehold of or who holds a license or lease from the Crown of land which, together with the lands included in any lease applied for, comprises more than 640 acres, is capable of becoming a lessee. This does not apply to persons who may become lessees or sub-lessees by marriage, or under a will, or by an intestacy.

As to Preparation, Cost, Execution, and Registration of Leases.

Leases are prepared by the Commissioners of Crown Lands, are registered under the Land Transfer Acts, and are exempted from stamp duty.

Provisions as to Term, Payment of Rent and Taxes.

Every lease is for a fixed term of thirty years. All leases are renewable, all rents are payable in equal half-yearly instalments, in advance. Lessees are liable for all rates, taxes, or assessments.

Provisions as to Transfers, Sub-Leases, and Sales by Mortgage.

Leases may be transferred or sub-let, but the limits as to area of land owned or occupied have to be complied with by the new holder.

Surrenders of leases are permitted with the consent of the Land Board.

Leased lands may be resumed for public purposes on payment of compensation to be fixed by arbitration, a proportional abatement of rent being allowed.

Provisions as to Residence.

Every lessee must reside upon his land within six months of the commencement of his term, and continue to reside for six years. The Board may, however, in the case of bush lands, dispense with residence until two years, or, in the case of youths living with their parents or relatives, until three years after the commencement of the term; or may dispense with residence altogether if the lessee resides on land contiguous to his lease. This does not apply to leases acquired under an intestacy or by will. In case two lessees intermarry one may be absolved from the residential condition.

Improvement Conditions.

Each lessee must within one year from the date of his lease bring into cultivation not less than one-twentieth, within two years not less than one-tenth, within four years not less than one-fifth, of his leasehold; and within six years, in addition to the cultivation of one-fifth of the land, he must put on it substantial improvements to the value of £1 for every acre.

The definition of "substantial improvements" will be found at page (81.)

Right to acquire Freehold.

Any lessee of land outside a proclaimed goldfield or any education or endowment reserve has the right of purchase (if within the six years he has fulfilled all the improvement conditions) at a price fixed when the lease is granted, but not less than the estimated value on which he has paid rent at 5 per cent. Advantage must, however, be taken of the purchasing right within twelve years of the commencement of a lease.

Provisions as to Renewals.

Three years before the end of the term of a lease a valuation of the land and all substantial improvements is made by arbitration. After the award of the arbitrators, and at least three months before the expiry of the lease, the lessee chooses whether he will accept a fresh lease for twenty-one years at a rental of 5 per eent. on the gross value, as fixed by the arbitration, *after deducting the value of the substantial improvements of a permanent character.*

If the lessee does not accept a renewal of his lease, a new valuation of the improvements is made, and the lease is submitted to public tender for twenty-one years at an upset rent not greater than the rent at which the lease was originally offered. If any other

person than the lessee is declared the purchaser, he has to pay to the original lessee the value of the improvements.

In the event of a lease not being sold, the existing lessee may continue in occupation from year to year, so long as he pays the rent and fulfils the covenants of his lease, until a new lessee takes up the lease. At any time during his temporary occupation the existing lessee can obtain a renewed lease for a further period of twenty-one years on the terms first offered. An existing lessee gets a month's notice of intention to sell the lease of the land he occupies, and is allowed during that time to elect to accept a new lease on the terms first offered. All the provisions relating to original leases apply to renewed leases, the only difference being that renewed leases are for twenty-one instead of thirty years.

Special Settlements.

The Governor may from time to time set apart such blocks of rural land as he shall think fit, and declare the same open for special settlement, to an amount not exceeding one hundred thousand acres in any one financial year.

This system gives the opportunity to twenty-five or more persons of the same nationality, or having other common bond of union, to associate together to form a settlement.

The land may either be taken on deferred payments or perpetual lease, subject to the regulations.

Statistics.

Crown Lands sold, and Revenue, during Year ending 31st March, 1885.

The total area of Crown lands sold during the year ending on the 31st March, 1885, was as under:—

On Immediate Payments.

	Acres.		Purchasers.	Cash received.	Scrip.
Town lands ..	120	sold to	438	£82,110	£1,472
Suburban lands ..	903	"	190		
Rural lands ..	64,975	"	614		

On Deferred Payments.

	Acres.		Purchasers.	Cash received.
Agricultural ..	61,712	sold to	619	£88,579
Pastoral	8,027	"	2	
Village settlement	499	"	85	

There was also received for agricultural leases on goldfields, £2,723; perpetual leases, £2,349; for pastoral rents, £168,300; and from royalties, &c., £13,478: making a total revenue of £357,541.

Total Land sold or otherwise disposed of.

The total area of Crown land sold or otherwise disposed of, from the first return in 1856 to the 31st March, 1885, amounted to 17,710,027 acres, of which 12,558,507 acres were sold for cash, realizing the sum of £12,511,220.

Remaining on hand.

The following tabular statement shows the area of Crown land remaining on hand on the 31st March, 1885. This does not include land for the acquisition of which the Government is negotiating with the Natives, or the large area of land in permanent possession of the Natives; nor does it include the large reserves made for various public purposes:—

Land District.	Open for Selection 31st March, 1885.	Remaining at Disposal of Land Boards, exclusive of Native Lands.	Total.
NORTH ISLAND.	Acres.	Acres.	Acres.
Auckland	142,777	2,924,828	
Hawke's Bay	7,180	234,544	
Taranaki	9,435	529,060	
Wellington	29,752	1,336,823	
West Coast	30,805	192,585	
	219,949	5,217,840	5,437,789
SOUTH ISLAND.			
Nelson	5,818,483	..	
Marlborough	540,783	1,080,000	
Canterbury	3,622,296	1,468,967	
Westland	252,830	2,667,813	
Otago	144,000	9,918,268	
Southland	1,456,994	..	
	11,835,386	15,135,048	26,970,434

The total number of acres of Crown lands held for depasturing purposes on the 31st March, 1885, was 11,384,603 acres, in the hands of 1,232 holders, the rents and assessments of which amounted to £168,300.

LAND TRANSFER.

The Land Transfer Act, modelled upon the famous system introduced by Sir Robert Torrens in South Australia, has now been in operation in New Zealand for some years, and the simple and inexpensive means which it offers for dealing with landed property and mortgages have been freely and extensively taken advantage of, as is indicated by the figures in the following returns:—

RETURN FOR THE YEAR ENDING 31ST MARCH, 1885.

—	Extent.	Number.	Value.
	Acres.		£
Applications for registration	..	743	1,082,659
Transfers	..	7,225	3,031,341
Crown grants—			
Town and suburban	242	427	..
Country	118,356		
Mortgages	..	5,975	4,195,012

The fees paid to the Government on the above-mentioned transactions amounted to £27,091, being £21,927 for general fees and £5,164 for land assurance.

Titles Guaranteed.

The sum of £5,164 for land assurance represents a charge of one halfpenny in the pound on the value of land brought under the operation of the Act, in consideration of which the Government guarantees the titles. No claim, however, has yet arisen upon the assurance fund thus formed. The balance to credit of this fund on the 31st March, 1882, was £33,826.

Mortgages.

The following return shows the mortgage transactions under the Land Transfer Act for the year ending the 31st March, 1885 :—

District.	Amount remaining Secured by Mortgage on 31st March, 1884.	Amount Secured by Mortgage during Year ended 31st March, 1885.	Amount of Mortgages paid off during the same Period.	Amount remaining Secured by Mortgage on 31st March, 1885.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Auckland ..	2,371,143 13 0	570,048 14 0	231,976 0 0	2,709,216 7 0
New Plymouth ..	396,771 2 3	96,716 18 5	34,422 3 0	459,065 17 8
Wellington ..	2,335,203 7 4	499,804 17 11	316,022 0 0	2,518,986 5 3
Hawke's Bay ..	1,500,263 3 11	332,098 6 0	217,922 9 5	1,614,439 0 6
Nelson	343,661 6 9	89,717 12 11	52,891 12 6	380,487 7 2
Marlborough ..	177,800 4 2	50,790 0 0	37,043 0 0	191,547 4 2
Canterbury ..	9,003,926 16 6	1,444,247 5 0	1,163,303 0 0	9,284,871 1 6
Otago	4,990,453 17 7	630,037 0 0	283,799 0 0	5,336,691 17 7
Southland ..	3,223,345 7 5	473,330 13 3	173,537 0 0	3,523,139 0 8
Westland ..	69,774 2 10	8,220 17 6	6,665 0 0	71,330 0 4
Total ..	24,412,343 1 9	4,195,012 5 0	2,517,581 4 11	26,089,774 1 10
Corresponding period 1883–84	..	4,072,328 15 3	2,038,044 11 0	..

PUBLIC WORKS.

Any account of New Zealand's progress that failed to make special mention of the extraordinary changes wrought by what is commonly known as the "Immigration and Public Works policy" would indeed be incomplete.

The rugged character of the country generally, and the natural difficulties appertaining to many of the sites upon which the chief towns were built, very early necessitated a large outlay on roads and public works. The necessity was fully recognized, and to some extent met, by most of the Provincial Governments, who have justly received great credit for their far-seeing and liberal exertions in that direction. A great deal of road-making, often of a very costly character, was accomplished, harbour and other improvements begun, and immigration handsomely encouraged. Something was also done in the way of the making of railways, notably in Canterbury, where a line unusually difficult and expensive in construction, involving some heavy tunnelling, was successfully undertaken and carried through by the Provincial Government, in order to provide easy means of communication between Christchurch and the Port of Lyttelton. Some advance towards the construction of a main trunk line had also been made in the same province. In Otago, also, the City of Dunedin had been connected with Port Chalmers by a railway, constructed under the guarantee of the Otago Provincial Government, and some miles of railway had been made in Southland. But the work to be done in the colony generally was too vast to be grappled with by the separate exertions of a few local Governments. It was therefore proposed that the General Government should take in hand the execution of all public works of a colonial character, upon an extensive and well-defined system, and that a loan of ten millions be raised to provide funds for that purpose. The objects sought to be accomplished were defined to be,—

I. Systematic immigration on a large scale.
II. Construction of a main trunk railway throughout each Island.
III. Construction of roads through the interior of the North Island.
IV. The purchase of Native land in the North Island.
V. The supply of water on goldfields.
VI. The extension of telegraph works.

In accordance with the plan thus laid down, "The Immigration and Public Works Act, 1870," was passed by the Legislature, and many who were greatly alarmed when the scheme was first propounded to the country by Mr. (now Sir Julius) Vogel, and thought it wild and extravagant, have since admitted that the step taken was as wise

as it was bold. A considerable extent of country has been opened up and settled by a large and thriving population in a surprisingly short space of time. As facilities were offered for the conveyance of the products of agriculture, the value of land, of course, greatly increased: not its nominal value merely, but its actual value. Hundreds of thousands of acres, worth, before the advent of railways, from £1 to £3 an acre, were afterwards sold at prices ranging from £10 to £20 per acre, and, for the most part, bought by experienced farmers, who had made their money in the colony, and knew the real capability and value of the land so purchased. It may also be said that, in addition to the enormous reproductive indirect results of the Public Works policy, the outlay incurred, at least in the case of the railways constructed, is likely to prove a capital investment, and so be directly reproductive, many of the principal lines already yielding a fair interest on the money expended in their construction.

The total amount expended on public works by the General Government, from the date of the Immigration and Public Works Act of 1870, and similar subsequent Acts, and under their authority, up to the 31st March, 1885, is as under:—

Railways	£11,616,754
Roads and Road Boards	2,273,129
Coal mines	10,835
Water supply on goldfields ...	492,228
Works on Thames Goldfield ...	50,000
Telegraphs	484,017
Public buildings	1,420,914
Lighthouses and harbours ...	462,619
Departmental	227,596
	£17,038,092

Roads and Bridges.

A great deal of road-making has been done in New Zealand.

The district roads are undertaken by the various Road Boards. The total number of these Road Districts in 1884 was 294, and their expenditure in the same year amounted to a total of £198,935, the whole being expended on actual works, less the sum of £37,175 for expenses of administration.

Much road-making has also been done by the General Government, especially in the North Island. During the period extending from June, 1869, to March, 1885, the General Government expenditure in this department amounted to the sum of £2,048,129, the

roads constructed being over 3,000 miles. To this must be added £225,000 paid to Road Boards previous to the 31st March, 1881.

Railways.

Soon after the passing of the Immigration and Public Works Act in 1870, the construction of railways on a large and systematic scale was commenced, and has proceeded vigourously since that time. The total length of lines open for traffic in October, 1885, was 1,497 miles; and there were under construction 155 miles.

The total amount of money expended in the construction of railways up to the 31st March, 1885, was £12,856,627; but the cost of lines open for traffic at the same date was £11,810,194.

The following table gives a view of the progress made in railway construction between the years 1876 and 1885, and the annual revenue and expenditure:—

Year ending	Revenue.	Expenditure.	Expenditure per cent of revenue.	Number of Miles.	
				Constructed.	Under Construction.
	£	£			
30th June, 1877	469,051	337,445	71·94	860	304
,, 1878	569,898	405,896	71·22	1,053	163
,, 1879	758,096	545,479	71·95	1,140	204
31st March, 1880*	762,573	580,016	76·06	1,181	257
,, 1881	836,077	521,958	62·43	1,288	192
,, 1882	892,026	523,099	58·64	1,334	188
,, 1883	953,347	592,821	62·18	1,371	188
,, 1884	961,304	655,990	68·24	1,404	224
,, 1885	1,045,712	690,026	65·99	1,479	158

It will be seen that the cost of working the railways for the twelve months ending on the 31st March, 1885, was less than in the previous year, for the revenue for that period exceeded the expenditure by £355,686, the ratio of the expenditure to the revenue being 65·99 per cent. The receipts per mile for the same period averaged £727 4s. 7d., and the expenditure £479 17s. 5d. The railways which are open for traffic thus made a return on the capital spent in their construction of £3 0s. 3d. per cent., which may be taken as a favourable result, for it may reasonably be expected that, when the many links in the chain of railways contemplated for the North Island are completed, some of the North Island lines will give a better result than they do at present. Quite recently the Auckland, Napier, and Wellington sections have shown a marked improvement, the last-named line having, in 1885, had, with the exception of the Greymouth

* Owing to the change in the financial year this statement overlaps the previous year, for purposes of comparison.

coal line, the second highest annual yield per mile in the colony—viz., £898.

POST AND TELEGRAPH DEPARTMENT.

The difficulty of communication, naturally incidental to a newly-settled country like New Zealand, has been well met and mastered by an energetic and able postal organization, aided also by a very efficient telegraph system. In both services the policy has been to charge low rates, so as to give the public the greatest facilities for intercommunication.

The following figures, taken from the last report of the Postmaster-General and Commissioner of Telegraphs, will afford an indication of the extent to which these advantages have been made use of by the people.

The total revenue of the department for the year was £284,245, showing an increase of £15,060 on the previous year. Taking into account the sum of £70,830 for official postage, and £20,856 for official telegrams, the gross earnings of the department for the year amounted to no less than £119,433 in excess of the expenditure.

Postal Business.

The total number of letters, newspapers, post-cards, and book packets received during the year 1884, for delivery in New Zealand, may be seen in the following table :—

Where from.	Letters.	Newspapers.	Post-cards.	Book Packets.
United Kingdom	657,024	270,881	..	1,679,001
Australian Colonies	459,398	57,455	..	535,579
Other places	91,128	32,088	..	189,852
From places within the colony..	18,030,240	1,169,179	561,652	5,121,164
Totals	19,237,790	1,529,603	561,652	7,525,596

Compared with the returns of the previous year, letters increased 4·97 per cent., post-cards 3·51, book packets 20·73, and newspapers 8·16. This shows a considerable increase on the work of the previous year; and the work of the department, compared with former years, continues to advance in a proportion greater than the increase of population would seem to warrant, showing that the facilities for communication between the different parts of the colony are being annually improved.

The average number of letters posted in proportion to the estimated population was 28·39 to each person, the average in 1877 being 14·51. The increase of post-cards, since their introduction in 1877, is very marked.

There were 969 post-offices open on the 31st December, 1884.

In the transaction of money-order business, 186,052 orders were issued during the year for £572,666. The money orders issued in New Zealand for payment in the United Kingdom, Germany, the United States, Canada, and the Australian Colonies were £41,825 in number for £142,219, and 11,290 orders for £45,108 were issued in those countries for payment in New Zealand. There was accordingly a balance of £97,110 remitted out of the colony by means of money orders.

Besides the usual postal and telegraph money orders the convenience of the public has now been further provided for by the introduction of the system of transferable postal notes for small sums.

The telegraph was used during the year for the transmission of 16,496 orders, amounting to £64,735.

Postal communication with the United Kingdom is principally by way of San Francisco and by the New Zealand Shipping Company's Royal Mail steamers. Each of these services is four-weekly, thus affording alternate fortnightly communications. The average number of days within which the mails were delivered from London during the year was, *vid* San Francisco to Auckland, 38·31 days; to Wellington, 40·38; and to Dunedin, 41·62 days. The average passage homeward by the direct mail steamers was 39 days 6 hours, and 42 days 18 hours outward.

A considerable amount of correspondence also goes by way of Melbourne and Point de Galle. This route, however, takes longer than the San Francisco service.

Postage Rates.

The charge for postage of letters is, within towns, one penny per half-ounce or fraction thereof, and double that rate for delivery in any part of the colony or in any part of Australia. Penny stamped post-cards are also issued deliverable anywhere in New Zealand. The postage for book packets is at the rate of one penny for every two ounces, and the same scale applies to parcels coming within the category of the pattern and sample post. The limit of weight allowed for the inland pattern, sample, and book post is five pounds; and a packet must not exceed two feet in length, or one foot in width or depth. The postage rate on newspapers is one halfpenny within the colony, and double that sum for delivery in Australia and England. *Bonâ fide* magazines are charged one halfpenny for two ounces.

Telegraph System.

The telegraph system is entirely in the hands of the Government. The difficulties to be overcome before telegraphic communication was

generally established were of an unusual character, the country being to a large extent rugged and wild, while the Islands being divided by Cook Strait rendered it necessary to undertake the laying of a telegraph cable to connect them. The work, however, was pushed forward with great vigour. By July, 1873, 2,356 miles of line had been completed, carrying 4,574 miles of wire, at a cost (inclusive of the submarine cable) of £224,580. The number of miles of line now open is 4,264; of wire, 13,294.

Telegraph Business.

The following figures show the telegraph business done during the years ending on the 31st March, 1884, and 31st March, 1883 :—

	1884.	1883.
Number of messages ...	1,433,458	1,379,483
Cash received	£80,626	£81,401
Value of Government messages ...	£20,855	£21,555

According to the report of the Postmaster-General, the receipts of the telegraph branch of the department for the financial year ending on the 31st March, 1885, including credit taken for the value of Government messages, show a balance over working expenses of £24,430, equal to 4·50 per cent on the capital cost.

Telegraph Charges.

The large telegraph business indicated by the foregoing figures is doubtless due, in no small degree, to the introduction of a uniform and low scale of charges. For the first four years a mileage rate was charged of from 2d. to 6d. per word. In 1869 this was altered to a uniform rate of 2s. 6d. for the first ten words, and 6d. for every additional five words. In 1870 the charge was reduced to 1s. for the first ten words, and 6d. for each additional five words; and in 1873 the charge was yet further reduced, ten words being allowed free of charge for address and signature, and any additional words over the first ten being rated at one penny for each word. More recently a still further reduction has been made for a certain class of messages called by the somewhat awkward term of "delayed telegrams."

Telephone System.

The telephone exchange system is being rapidly extended. Exchanges are established in seven towns—namely, Auckland, Wellington, Nelson, Christchurch, Oamaru, Dunedin, and Invercargill. Two more will probably be opened, at Timaru and Napier. The total number of subscribers is 1,114. In Auckland, Wellington, and Dunedin there are more subscribers to the population than either in

London or New York, Chicago, Philadelphia, or Brooklyn, while the annual fee is less than one-half of what is charged in those cities. The number of subscribers to the New Zealand exchanges is exclusive of the free connections, of which there are 76.

GOVERNMENT LIFE ASSURANCE.

An Act was passed in 1869 empowering the Governor to grant life assurances and annuities on the security of the colonial revenue, and the business was actually commenced in March, 1870. As may be seen by the statement below, from very small beginnings the business steadily increased; the total number of policies in force up to the 31st December, 1884, being 28,925, representing an aggregate insurance amounting to over £6,300,000, while the amount of the accumulated funds at the same date was £972,775, and has since exceeded one million sterling.

It may be useful in this manual to notice the principal advantages offered to policy-holders by the Government Insurance Association of New Zealand, which is the first British colony that has, by special legislation and exceptional attractions, stimulated the growth of those self-dependent and provident habits that lie at the root of the life-assurance system. These advantages may be briefly stated as follow :—

1. The inviolable security offered to the assured, the payment of every policy being guaranteed by the colony under a special Act of Parliament.

2. The division of profits, the whole of which are by law to be divided amongst policy-holders only, who thereby enjoy the advantages possessed by members of mutual companies, in addition to that of having the security of the colony for the payment of claims. The first quinquennial investigation showed a profit of over £12,000; and the investigation which took place on the 30th June, 1880, showed the surplus funds to amount to £77,595. Out of this sum, £56,000 was divided amongst policy-holders.

3. The low scale of premiums comes next in order. The premiums are as low as the non-participating rates in other offices, and yet they entitle policy-holders to a full share of the profits that may accrue.

4. Policies contain no restrictive conditions as to voyaging, trade, or occupation, and are indisputable and unchallengeable after five years' duration, if age has been admitted.

The subjoined tabular statement will show the remarkable growth of the business of this department :—

COMPARATIVE RETURN OF POLICIES ISSUED.

Year ending 30th June.	Number of Policies.	Sum Assured.	Year ending 30th June.	Number of Policies.	Sum Assured.
		£			£
1870	53	27,800	1878	1,991	680,600
1871	409	178,674	1879	2,057	682,200
1872	1,355	456,225	1880	2,274	725,254
1873	1,161	429,450	1881	1,790	550,351
1874	1,499	506,910	*1882	13,259	1,335,968
1875	1,450	498,715	1883	8,718	1,077,457
1876	1,485	504,509	1884	5,988	821,442
1877	1,409	563,928			
			Totals ..	44,898	9,759,483

*In 1882 the end of the financial year was changed from the 30th June to the 31st December.

PUBLIC TRUST OFFICE.

A public institution, not less important in its bearing on the social welfare of the colony than the foregoing, is the Public Trust Office of New Zealand, which was established by Act in 1872. The object of this department is the administration of intestate estates, the executorship of wills, and the administration of trusts under settlements and deeds. The obvious advantage of this office is that the Public Trustee has uninterrupted control of the business entrusted to the department, thus avoiding the loss and delay involved in the transfer of trusts and the re-appointment of trustees. The Government of the colony is responsible for the honest fulfilment of the trusts, and all investments are under control of an official board, consisting of the Colonial Treasurer, Attorney-General, Controller and Auditor-General, and Public Trustee.

The popularity of this institution may be judged of from the following return of the cash receipts from all sources :—

1880.	1881.	1882.	1883.	1884.	1885.
£41,813	£68,262	£71,319	£90,119	£116,136	£195,000 (estimated)

EDUCATION.

STATE SCHOOLS, PRIVATE SCHOOLS.

The total number of common schools receiving Government aid and under the control of Education Boards was, in December, 1884, 987 (against 943 in 1883), having a total of 2,447 teachers, and with the names of 97,238 pupils on the books; the daily average attendance numbering 75,391. There were also at the principal centres of population superior schools, most of which have been endowed, directly or indirectly, with lands and money out of the public estate. The number of private schools in December, 1884 (from which returns

were received), was 265, the number of teachers being 614, and pupils 12,203.

The public schools are free, and the instruction imparted to them is secular, because the cost is defrayed by an annual parliamentary vote. For 1884 the expenditure was £389,564, of which £49,679 was for buildings. The average expenditure for each scholar in attendance was £3 15s. 0¼d., of which 10s. 3d. has been for buildings. Some of the endowed secondary schools, and the three endowed collegiate institutions in Otago, Canterbury, and Auckland, are affiliated to the New Zealand University, which is an examining body, having power to confer degrees, and to grant scholarships, and is maintained by an annual grant from the consolidated revenue.

Native Schools.

The number of schools at the end of 1884 for the education of the Maori race was 71. The number of pupils amounted to 2,226, an increase, as compared with the previous year, of 303. The average attendance during the year was 1,733. The number of instructors was 115. The cost of the education of Native children (excluding those who attend the public schools) was, for the year 1884, £15,448.

Many European schools also received subsidies from the Government for the support of Maori pupils: 703 Maoris—viz., 386 boys and 317 girls—attended these schools, a decrease on the previous year of 80 boys and an increase of 2 girls. Thus the total number of Maori children receiving education in 1884 amounted to 2,929.

CONSTABULARY, VOLUNTEERS, FIRE BRIGADES.

Constabulary.

The total strength of the Constabulary on the 31st March, 1885, amounted to 861 men of all ranks. Of this number, 474—viz., 18 officers, 67 non-commissioned officers, and 423 constables—were engaged in the police duty of the colony; while the reserves, consisting of 15 officers, 62 non-commissioned officers, and 310 constables, were performing duties of a military character.

Volunteers.

The various branches of the Volunteer Force on the 30th June, 1885, had a total strength of 9,511 officers and men, including

1,592 cadets, belonging to 154 corps. The totals of each branch of the service were as follow:—

Garrison Corps.

	Corps.	Strength.
Cavalry	9	... 537
Mounted Infantry ...	2	... 78
Naval Artillery	18	... 1,169
Artillery	13	... 835
Engineers	3	... 166
Rifles	40	... 2,793
Cadets	24	... 1,592

Country Corps.

	33	... 1,648

Honorary Corps.

	12	... 693

In October, 1881, when it was decided to advance against Te Whiti at Parihaka, the Districts of Auckland, Nelson, Marlborough, Wellington, and Canterbury were called upon for volunteers for active service, and readily afforded a contingent of 64 officers and 1,048 men, while hundreds were anxious to go whose services were not accepted. The campaign was, however, only demonstrative, as the Maoris suffered themselves to be taken into custody without offering resistance; but the officer commanding the forces recorded his high appreciation of the exemplary and soldierlike manner in which the whole force behaved under the circumstances.

Fire Brigades.

In 1884 there were 52 fire brigades in the colony, having a total strength of 191 officers and 928 men.

DESCRIPTIVE LIST OF THE PRINCIPAL FOREST TREES OF NEW ZEALAND.

Order—Coniferæ.

Genus—*Dammara*, L'Héritier.

Dammara australis, Lambert.

Kauri.—The kauri is the finest forest tree in New Zealand, and attains a height of 120ft. to 160ft. The trunk is sometimes 80ft. to 100ft. high before branching, and attains a diameter at the base of 10ft. to 20ft.

The timber is in high repute for masts and spars, deck and other planking of vessels, and is largely used for house finishings. There is abundant evidence of its durability for more than fifty years in some of the old mission-buildings at the Bay of Islands. The buried logs of an ancient kauri forest near Papakura have been excavated and found to be in perfectly sound condition, and were used for sleepers on the Auckland and Waikato Railway. On the Thames Goldfield kauri is used for mine-props, struts, and cap-pieces. It forms the bulk of the timber exported from New Zealand.

Some of the largest and soundest kauri timber has richly mottled shading, which appears to be an abnormal growth, due to the bark being entangled in the ligneous growth, causing shaded parts, broad and narrow, according as the timber is cut relative to their planes. This makes a rich and valuable furniture wood, and in the market is known as "mottled kauri."

The kauri pine occurs only in the North Island and north of Mercury Bay, and grows best near the sea on wet clay land. The kauri forests are largely composed of other trees as well as their characteristic tree.

The turpentine of this tree forms the celebrated kauri gum, which is extensively excavated from the sites of old forests as far south as Taranaki. In 1871 there were exported 5,053 tons, valued at £167,958; in 1875, 2,230 tons, valued at £138,528; in 1877, 3,632 tons, valued at £118,348; in 1882, 5,533 tons, valued at £260,369; and in 1884, 6,393 tons, valued at £342,151.

Genus—*Libocedrus*, Endl.

Libocedrus doniana, Endl.

Kawaka, Cypress, Cedar.—This handsome tree attains a height of 60ft. to 100ft., and a diameter of 3ft. to 5ft. Wood reddish, fine-grained and heavy; used by the Maoris for carving, and said to be excellent for planks and spars; grows in the North Island, being abundant in the forests near the Bay of Islands and to the north of Auckland.

Libocedrus bidwillii, Hook.

Pahautea, Cedar.—A handsome conical tree 60ft. to 80ft. high, 2ft. to 3ft. in diameter. In Otago, it produces a dark-red free-working timber, rather brittle, chiefly adapted for inside work. Found on the central ranges of the North Island, and common thoughout the forests of the South Island, growing at altitudes of 500ft. to 4,000ft. This timber has been used for sleepers on the Otago railways of late years, is largely employed in that district for fencing

purposes, and is frequently mistaken for totara. In former years it was believed to be suitable only for inside work.

Genus—*Podocarpus*, L'Héritier.

Podocarpus ferruginea, Don.

Miro, Bastard Black-pine of Otago.—A large ornamental and useful timber tree; attains a height of 40ft. to 60ft., trunk 2ft. to 3ft. in diameter. A useful wood, but not so durable as the matai or true black-pine wood; reddish, close-grained, and brittle; the cross section of the timber shows the heartwood star-shaped and irregular. The timber is generally thought to be unfitted for piles and marine works, except when only partially exposed to the influence of sea-water, as shown in the railway embankment at Bluff Harbour, where it is reported to have been durable. Grows in the North and South Islands at altitudes below 1,000ft.

Podocarpus totara, A. Cunn.

Totara.—A lofty and spreading tree, 60ft. to 120ft. high, 4ft. to 10ft. in diameter, Wood very durable and clean-grained, in appearance like cedar, and works with equal freedom; it is adapted for every kind of carpenters' work. It is used extensively in Wellington for house-building and piles of marine wharves and bridges, and railway sleepers, and is one of the most valuable timbers known. The wood, if felled during the growing season, resists for a long time the attacks of toredo worms. It splits freely, and is durable as fencing and shingles. Totara post-and-rail fences are expected to last from forty to fifty years. The Maoris made their largest canoes from this tree, and the palisading of their pas consisted almost entirely of this wood. Grows throughout the North and South Islands upon both flat and hilly ground; the timber from trees grown on hills is found to be the most durable.

Podocarpus spicata, Br.

Matai, Mai, Black-pine of Otago.—A large tree, 80ft. high, trunk 2ft. to 4ft. in diameter. Wood yellowish, close-grained, and durable; used for a variety of purposes—piles for bridges, wharves, and jetties, bed-plates for machinery, millwrights' work, flooring, house-blocks, railway-sleepers, and fencing. Bridges in various parts of the colony afford proof of its durability. Mr. Buchanan has described a log of matai that he found had been exposed for at least two hundred years in a dense damp bush in North-East Valley, Dunedin, as proved by its being enfolded by the roots of three large

trees of *Griselinia littoralis*, 3ft. 6in. in diameter, with over 300 growth rings. Grows in both North and South Islands at altitudes under 1,500ft.

Podocarpus dacrydioides, A. Rich.

Kahikatea, White-pine.—A very fine tree, 100ft. to 150ft. high; trunk 4ft. in diameter. Timber white and tough, soft, and well adapted for indoor work, but will not bear exposure. Abundant throughout the North and South Islands. When grown on dry soil it is good for the planks of small boats, but when from swamps it is almost useless. A variety of this tree, known as yellow-pine, is largely sawn in Nelson, and considered to be a durable building timber.

Genus—*Dacrydium*.

Dacrydium cupressinum, Soland.

Rimu, Red-pine.—Tree pyramidal, with weeping branches when young; trunk 80ft. to 130ft. high, and 2ft. to 6ft. in diameter. An ornamental and useful timber; wood red, clear-grained, heavy, and solid; much used for joisting and planking, and general building purposes, from Wellington southward. Its chief drawback is in being liable to decay under the influence of wet. It is largely used in the manufacture of furniture, the old wood being handsomely marked like rosewood, but of a lighter-brown hue. The juice of this pine is agreeable to drink, and was manufactured into spruce beer by Captain Cook. Grows throughout the North and South Islands, but is of best quality in the central district.

Dacrydium colensoi, Hook.

Manoao, Yellow-pine.—A very ornamental tree, 20ft. to 80ft. high. Wood light yellow. It is the most durable and strongest timber in New Zealand. Posts of this wood have been in use among the Maoris for several hundred years. Grows in the North and South Islands up to 4,000ft. altitude. This tree is curious from having two kinds of leaves on the same branches. It is greatly valued for furniture.

Genus—*Phyllocladus*.

Phyllocladus trichomanoides, Don.

Tanekaha, Celery-leaved Pine.—A slender, handsome tree, 60ft. high; trunk rarely exceeds 3ft. in diameter; wood pale, close-grained, and excellent for planks and spars; resists decay in moist positions

in a remarkable manner. Grows in the North Island, especially in the hilly districts.

Phyllocladus alpinus, Hook.

Toatoa.—A small ornamental and densely-branched tree, sometimes 2ft. in diameter. Bark used for dyeing and making tar. Found in both North and South Islands.

Order—CUPULIFERÆ.

Genus—*Fagus*, Linn.

Fagus menziesii, Hook.

Tawhai, Red-birch (from the colour of the bark).—A handsome tree, 80ft. to 100ft. high; trunk 2ft. to 3ft. in diameter. The timber is chiefly used in the lake district in the South Island. Durable and adapted for masts and oars, and for cabinet and cooper's work. Grows in the North Island on the mountain-tops, but abundant in the South Island at all altitudes to 3,000ft.

Fagus fusca, Hook.

Tawhai, Tawhairaunui, Black-birch of Auckland and Otago (from colour of bark), Red-birch of Wellington and Nelson (from colour of timber).—This is a noble tree, 60ft. to 90ft. high; the trunk 5ft. to 8ft. in diameter. The timber is excessively tough and hard to cut. It is highly valued in Nelson and Wellington as being both strong and durable for all purposes. It is found from Kaitaia in the North Island to Otago in the South Island, but is often locally absent from extensive districts, and grows at all heights up to 3,000ft. altitude.

Fagus solandri, Hook.

White-birch of Nelson and Otago (from colour of bark), Black-heart Birch of Wellington.—A lofty, beautiful evergreen tree, 100ft. high; trunk 4ft. to 5ft. in diameter. The heart timber is darker than that of *Fagus fusca*, and is very durable. The wood is well adapted for fencing and bridge piles, and the bark is useful as a tanning material. This tree occurs only in the southern part of the North Island, but is abundant in the South Island, at 3,000ft. to 5,000ft. altitude.

Order—MYRTACEÆ.

Genus—*Leptospermum*, Forst.

Leptospermum scoparium, Forst.

Kahikatoa, Tea-tree of Cook.—It is ornamental, and useful for

fuel and fencing; generally a small shrub, but occasionally 20ft. in height in the South. Abundant throughout the Islands.

Leptospermum ericoides, A. Rich.

Manuka.—A slender tree, 10ft. to 80ft. high, highly ornamental, more especially when young. The timber can be had 28ft. to 30ft. long, 14in. in diameter at the butt, and 10in. at the small end. The wood is hard and dark-coloured, largely used at present for fuel and fencing, axe-handles and sheaves of blocks, and formerly by the Natives for spears and paddles. The old timber, from its dark-coloured markings, might be used with advantage in cabinet-work, and its great durability might recommend it for many other purposes. Highly valued in Otago for jetty and wharf piles, as it resists the marine worm better than any other timber found in the district. It is extensively used for house-piles. The lightest-coloured wood, called "white manuka," is considered the toughest, and forms an excellent substitute for the "hornbeam" in the cogs of large spur-wheels. It is abundant as a shrub, and is found usually on the poorest soils, but is rare as a tree in large tracts to the exclusion of other trees.

Genus—*Metrosideros*, Br.

Metrosideros lucida, Menzies.

Rata, Ironwood.—A very ornamental tree; attains a height of 30ft. to 60ft., and a diameter of 2ft. to 10ft. The timber of this tree forms a valuable cabinet wood; is of a dark-red colour; splits freely. It has been much used for knees and timbers in ship-building, and would probably answer well for cogs of spur-wheels. Grows rarely in the North Island, but is abundant in the South Island, especially on the West Coast.

Metrosideros robusta, A. Cunn.

Rata.—A tall erect tree, 50ft. to 60ft. high; diameter of trunk 4ft., but the descending roots often form a hollow stem 12ft. in diameter. Timber closely resembles the last-named species, and is equally dense and durable, while it can be obtained of much larger dimensions. It is used for ship-building, but for this purpose is inferior to the pohutukawa. On the tramways at the Thames it has been used for sleepers, which are perfectly sound after some years' use. Grows in the North Island; usually found in hilly situations from Cape Colville southwards.

Metrosideros tomentosa, A. Cunn.

Pohutukawa.—This tree has numerous massive arms; its height

is 30ft. to 60ft.; trunk 2ft. to 4ft. in diameter. The timber is specially adapted for the purposes of the shipbuilder, and has usually formed the framework of the numerous vessels built in the northern districts. Grows on rocky coasts, and is almost confined to the Provincial District of Auckland.

Order—MELIACEÆ.

Genus—*Dysoxylum*, Blum.

Dysoxylum spectabile, Hook.

Kohekohe.—A large forest tree about 40ft. to 50ft. high. Its leaves are bitter, and used to make a stomachic infusion; wood tough, but splits freely, and is considered durable as piles under sea-water. Grows in the North Island.

Genus—*Eugenia*.

Eugenia maire, A. Cunn.

Mairetawhake.—A small tree about 40ft. high; trunk 1ft. to 2ft. in diameter. Timber compact, heavy, and durable. Used for mooring-posts and jetty-piles on the Waikato, where it has stood well for many years. It is highly valued for fencing. Common on swampy land in the North Island.

Order—ONAGRARIEÆ.

Genus—*Fuchsia*, Linn.

Fuchsia excorticata, Linn.

Kotukutuku. The fruit is called Konini.—A small and ornamental tree, 10ft. to 30ft. high; trunk sometimes 3ft. in diameter. It appears to furnish a durable timber. House-blocks of this wood, which had been in use in Dunedin for more than twenty years, were still sound and good. The wood might be used as dye-stuff, if rasped up and bled in the usual way, and, by mixing iron as a mordant, shades of purple may be produced even to a dense black, that makes good writing ink. The juice is astringent and agreeable, and yields a medical extract. Its fruit is pleasant, and forms the principal food of the wood-pigeon. Grows throughout the Islands.

Order—ARALIACEÆ.

Genus—*Panax*, Linn.

Panax crassifolium, Dcne. and Planch.

Horoeka, Ivy Tree.—An ornamental, slender, and sparingly-branched tree. It has a singularly graceful appearance in the young

state, having long reflexed leaves. The wood is close-grained and tough. Common in forests throughout the Islands.

Order—CORNEÆ.

Genus—*Griselinia,* Forst.

Griselinia littoralis, Raoul.

Pukatea, Broadleaf.—An erect and thickly-branched bush-tree, 50ft. to 60ft. high; trunk 3ft. to 10ft. in diameter. Wood splits freely, and is valuable for fencing and in shipbuilding; some portions make handsome veneers. Grows chiefly in the South Island and near the coasts.

Order—COMPOSITÆ.

Genus—*Olearia,* Mœnch.

Olearia avicenniæfolia, Hook.

Mingimingi, Yellow-wood.—An ornamental shrub-tree; flowers numerous; trunk 2ft. in diameter. Wood close-grained, with yellow markings, which render it desirable for cabinet-work; good for veneers. Occurs in South Island.

Olearia nitida.

An ornamental shrub-tree, 20ft. high and 2ft. in diameter. Wood close-grained, with yellow markings; useful for cabinet-work. Found in the mountainous region of the North Island and throughout the South Island.

Olearia cunninghamii.

An ornamental shrub-tree, 12ft. to 20ft. high, with very showy flowers. Found abundantly on west coast of South Island, and not uncommon in North Island.

Order—ERICEÆ.

Genus—*Dracophyllum,* Lab.

Dracophyllum longifolium, Br.

Neinei.—An ornamental shrub-tree with long grassy leaves. Wood white, marked with satin-like specks, and adapted for cabinet-work. Grows in South Island and in Lord Auckland's Group and Campbell Island; none of the South Island specimens are as large in the foliage as those in Auckland Islands. In the vicinity of Dunedin attains a diameter of 10in. to 12in.

Order—VERBENACEÆ.

Genus—*Vitex.*

Vitex littoralis, A. Cunn.

Puriri.—A large tree, 50ft. by 60ft. high; trunk 20ft. in girth. Wood hard, dark olive-brown, much used; said to be indestructible under all conditions. Grows in the northern parts of the North Island only. Considered very valuable for railway-sleepers.

Order—LAURINEÆ.

Genus—*Nesodaphne,* Hook.

esodaphne tarairi, Hook.

Tarairi.—A lofty forest tree, 60ft. to 80ft. high, with stout branches. Wood white, splits freely, but not much valued. Grows in northern parts of North Island.

Nesodaphne tawa, Hook.

Tawa.—A lofty forest tree, 60ft. to 70ft. high, with slender branches. The wood is light and soft, and is much used for making butter-kegs. Grows in the northern parts of the South Island and also in the North Island, chiefly on low alluvial grounds; is commonly found forming large forests on river-flats.

Order—MONIMIACEÆ.

Genus—*Atherosperma,* Lab.

Atherosperma novæ-zealandiæ, Hook.

Pukatea.—Height, 150ft., with buttressed trunk 3ft. to 7ft. in diameter; buttresses 15ft. deep at the base; wood soft and yellowish, used for small boat planks. A variety of this tree has dark-coloured wood that is very lasting in water, and greatly prized by the Maoris for making canoes. Grows in the North Island, and northern parts of the South Island.

Genus—*Hedycarya,* Forst.

Hedycarya dentata, Forst.

Kaiwhiria.—A small evergreen tree, 20ft. to 30ft. high; the wood is finely marked and suitable for veneering. Grows in the North Island, and as far south as Akaroa in the South Island.

Order—PROTEACEÆ.

Genus—*Knightia,* Br.

Knightia excelsa, Br.

Rewarewa.—A lofty slender tree, 100ft. high. Wood handsome,

mottled red and brown, used for furniture and shingles, and for fencing, as it splits easily. It is a most valuable veneering wood. Common in the forests of the North Island, growing upon the hills in both rich and poor soils.

Order—MAGNOLIACEÆ.

Genus—*Drimys.*

Drimys axillaris, Forst.

Horopito, Pepper-tree, Winter's Bark.—A small slender evergreen tree, very handsome. Whole plant aromatic and stimulant; used by the Maoris for various diseases. Wood very ornamental in cabinet-work, making handsome veneers. Grows abundantly in forests throughout the Islands. At altitudes of 1,000ft. the foliage becomes dense and reddish-coloured.

Drimys colorata, Raoul.

This is a very distinct species, very common near Dunedin; it is a very ornamental shrub-tree, with leaves blotched with red.

Order—VIOLARIEÆ.

Genus—*Melicytus,* Forst.

Melicytus ramiflorus, Forst.

Mahoe, Hinahina.—A small tree, 20ft. to 30ft. high; trunk often angular, and 7ft. in girth. The wood is soft and not in use. Abundant throughout the Islands as far south as Otago. Leaves greedily eaten by cattle.

Order—MALVACEÆ.

Genus—*Hoheria,* A Cunn.

Hoheria populnea, A. Cunn.

Houhere, Ribbonwood of Dunedin.—An ornamental shrub-tree, 10ft. to 30ft. high. Bark fibrous and used for cordage, and affords a demulcent drink. Wood spilts freely for shingles, but is not durable. Grows abundantly throughout the Islands. Bark used for making a tapa cloth by the Maoris in olden times.

Order—TILIACEÆ.

Genus—*Aristotelia.*

Aristotelia racemosa, Hook.

Mako.—A small handsome tree, 6ft. to 20ft. high, quick growing,

with large racemes of reddish nodding flowers. Wood very light, and white in colour, and might be applied to the same purposes as the lime-tree in Britain; it makes good veneers.

Genus—*Elæocarpus*, Linn.

Elæocarpus dentatus, Vahl.

Hinau.—A small tree, about 50ft. high, and 18in. thick in stem, with brown bark which yields a permanent blue-black dye, which is used for tanning; it is used by the Maoris for colouring mats and baskets. Wood a yellowish-brown colour and close-grained; very durable for fencing and piles. Common throughout the Islands.

Order—OLACINEÆ.

Genus—*Pennantia*, Forst.

Pennantia corymbosa, Forst.

Kaikomako.—A small, very graceful tree, with white sweet-smelling flowers; height 20ft to 30ft. Wood used by the Maoris for kindling fires by friction. Grows on the mountains of the North Island, and more abundantly throughout the South Island.

Order—RHAMNEÆ.

Genus—*Discaria*, Hook.

Discaria toumatou, Raoul.

Tumatakuru, Wild Irishman.—A bush or small tree with spreading branches; if properly trained would form a handsome hedge that would be stronger than whitehorn. The spines were used by the Maoris for tatooing.

Order—SAPINDACEÆ.

Genus—*Dodonæa*, Linn.

Dodonæa viscosa, Forst.

Ake.—A small tree, 6ft. to 12ft. high. Wood very hard, variegated black and white; used for Maori clubs; abundant in dry woods and forests.

Genus—*Alectryon*, Gærtner.

Alectryon excelsum, DC.

Titoki.—A beautiful tree with large panicles of reddish flowers. Trunk 15ft. to 20ft. high, and 12in. to 20in. in diameter. Wood has similar properties to ash, and is used for similar purposes. Its

toughness makes it valuable for wheels, coach-building, &c.; the oil of the seeds was used for anointing the person. Grows in the North and South Islands; not uncommon in forests.

Order—CORIARIEÆ.

Genus—*Coriaria*, Linn.

Coriaria ruscifolia, Linn.

Tupakihi, Tree Tutu.—A perennial shrub 10ft. to 18ft. high; trunk 6in. to 8in. in diameter. The so-called berries (fleshy petals) vary very much in succulence, the less juicy bearing seeds which, according to Colenso, are not poisonous. The juice is purple, and affords a grateful beverage to the Maoris; and a wine, like elderberry wine, has been made from them. The seeds and leaves contain a poisonous alkaloid, and produce convulsions, delirium, and death, and are sometimes fatal to cattle and sheep. Abundant throughout the Islands.

Order—LEGUMINOSÆ.

Genus—*Sophora*. Linn.

Sophora tetraptera, Aiton.

Kowhai.—A small or middling-sized tree. It has a splendid appearance, with large pendulous yellow flowers. Wood red; valuable for fencing, being highly durable; it is also adapted for cabinet-work. It is used for piles in bridges, wharves, &c. Abundant throughout the Islands.

Order—SAXIFRAGEÆ.

Genus—*Carpodetus*, Forst.

Carpodetus serratus, Forst.

Tawiri, White Mapau, White-birch (of Auckland).—A small tree, 10ft. to 30ft. high; trunk unusually slender; branches spreading in a fan-shaped manner, which makes it of very ornamental appearance; flower white, profusely produced. The wood is soft and tough, and might be used in the manufacture of handles for agricultural implements and axes. Grows in the North and South Islands; frequent by the banks of rivers.

Genus—*Weinmannia*, Linn.

Weinmannia racemosa, Forst.

Towhai, Kamahi.—A large tree; trunk 2ft. to 4ft. in diameter, and 50ft. high. Wood close-grained and heavy, but rather brittle;

might be used for plane-making and other joiners' tools, block-cutting for paper and calico printing, besides various kinds of turnery and wood-engraving. The bark of this tree is largely used for tanning. The extract of bark is chemically allied to the gum kino of commerce, their value being about equal. Grows in the middle and southern parts of the North Island and throughout the South Island.

Order—RUBIACEÆ.

Genus—*Coprosma*, Forst.

Coprosma linariifolia, Hook.

Karamu.—An ornamental shrub-tree; wood close-grained and yellow; might be used for turnery. Grows in mountain localities of the North and South Islands.

Several other species of this genus grow to a considerable size, and have ornamental timber. It has been proposed to use the berries of *C. baueriana* as a substitute for coffee.

Order—JASMINEÆ.

Genus—*Olea*, Linn.

Olea cunninghamii, Hook, fil.

Black Maire.—40ft. to 50ft. high, 3ft. to 4ft. in diameter; timber close-grained, heavy, and very durable. Much of this very valuable timber is being destroyed in clearing the land.

Order—SANTALACEÆ.

Genus—*Santalum*, Linn.

Santalum cunninghamii, Hook. fil.

Maire.—A small tree 10ft. to 15ft. high, 6in. to 8in. in diameter; wood hard, close-grained, heavy. Used by the Maoris in the manufacture of war implements. Has been used as a substitute for box by wood-engravers.

MINERAL WATERS.

PRINCIPAL MINERAL SPRINGS.

New Zealand is singularly rich in springs of water that hold mineral salts in solution, and some of these are already noted for their valuable medicinal properties.

Both hot and cold springs are found, the former being, with few

exceptions, confined to the districts of the North Island where volcanic forces have been active during the latest Tertiary period, and are not yet altogether dormant. A few thermal springs are found to escape from the Upper Mesozoic rocks, in localities where the source of heat can only be attributed to chemical decomposition of bituminous matters and sulphides; and in a few instances warm waters spring from Palæozoic rock-formations in the South Island. The cold mineral springs have a wider distribution, but have only as yet been examined from comparatively few localities.

The mineral waters of New Zealand are classified, from analyses that have been made in the Colonial Laboratory, under the following groups:—

Saline.—Containing chiefly chloride of sodium.

Alkaline.—Containing carbonates and bicarbonates of soda and potash.

Alkaline Siliceous.—Waters containing much silicic acid, but changing rapidly on exposure to the atmosphere, and becoming alkaline.

Hepatic or Sulphurous.—Waters the prominent character of which is the presence of sulphuretted hydrogen and sulphurous acid.

Acid Waters.—In which there is an excess of mineral acids, such as hydrochloric and sulphuric acid.

The following is a list of the best-known mineral springs, full details concerning which are to be found in the Official Laboratory Reports:—

No.	Name and Locality.	Temp. Fahr.	Grains per Pint.	Chemical Character of Water.
	Bay of Islands District.	Deg.		
	Ohaeawai and Pakaraka	60–116	16·8	Acid, aluminous; deposits mercury.
	Hauraki District.			
	Waiwera	110	17·7	Alkaline, saline.
3	Puriri	60	67·1	Carbonated, alkaline.
	Bay of Plenty.			
4	White Island Lake	97–212	1850·8	Strongly acid.
5	White Island Springs	210	26·1	,,
	Rotomahana.			
6	Pink Terrace Geyser	208	19·3	Sulphurous.
7	White Terrace Geyser	210	18·0	Alkaline.
	Whakarewarewa.			
8	Turikore, or Spirit Bath	96–120	10·9	Sulphurous.
9	Koroteoteo, or Oil Bath	214	13·0	Caustic, alkaline.
10	Ngatarawa, Gas Pool	124	8·4	Sulphurous.
11	Papatangi, Lobster-pot	110	5·7	,,

No.	Name and Locality.	Temp. Fahr.	Grains per Pint.	Chemical Character of Water.
	Arikikapakapa.	Deg.		
12	Mud Bath	98	9·2	Saline, acidic.
13	Sulphur Pool	160	6·8	Acidic.
14	Sulphur Spring	78–98	10·0	,,
15	Sulphur Stream	80	8·5	,,
16	Mud Lake	65	6·8	,,
	Rotorua.			
17	Tapui te Koutou, Graham's Farm Bath	90–108	9·1	Alkaline.
18	Kuirau, Washing Spring	136–156	9·9	Alkaline, siliceous.
19	Waihunuhunukuri, Lake House Clear Bath	130–170	7·3	Alkaline.
20	Lake House Acid Bath	150	11·4	Acidic.
21	Waikite (*a*), Morrison's Hotel Bath ..	120	9·4	Alkaline.
22	Waikite (*b*), Scott's Bath	116	9·6	,,
23	Hinemaru, Hughes's Baths	170	16·7	,,
24	Te Kauwhanga (*a*), Cameron's Bath ..	115	10·1	Acidic.
25	Te Kauwhanga (*b*), Painkiller ..	204	13·8	Acidic and hepatic.
26	Perekari, Sulphur Point Boiling Pool..	130–150	7·0	Acidic.
27	Mud Bath, Sulphur Point	120	7·8	Acidic and hepatic.
28	Hot Pool, Sulphur Point	200	12·1	Acid.
29	Whangapipiro, Madame Rachel's Bath	170–210	14·7	Alkaline and siliceous
30	Otamawhata	144	11·4	Alkaline.
31	Hospital Lake	66	11·3	Acidic.
32	Te Pupunitanga, Priest's Bath ..	94–110	12·1	,,
	Rotoiti.			
33	Te Kute, mud lake at Tihitari ..	100–212	6·1	Acidic, hepatic.
34	Te Mimi, hot waterfall, from 38° C. ..	90–112	3·8	Acidic.
	Taupo District.			
35	Rotokawa, Black Water	192	17·8	Acidic.
36	,, Yellow Water	152	22·0	,,
37	Wairakei, Piroirori, or White Water ..	112	1·8	Alkaline.
38	Ruahine, Crow's Nest	180	19·2	,,
39	,, Witches' Cauldron	192	20·8	,,
40	,, Ohinekahoro	195	23·0	,,
41	,, spring on flat near track ..	132	2·2	Feebly saline.
42	Otumahike, Acacia	136	3·9	Feebly alkaline.
43	Lofley's Gully, McPherson's	96	1·9	,,
44	,, cold stream	76	1·3	,,
45	,, warm stream.. ..	114	2·8	,,
46	,, Sumach	106	3·0	,,
47	,, Source No. 1	106	3·0	Alkaline, siliceous.
48	,, Source No. 2	136	19·0	Alkaline, saline.
49	,, Kokowai	104	2·0	Feebly saline.
50	Waipahihi, A.C. Bath No. 1	110	4·7	Chlorinated saline.
51	,, ,, No. 2	146	5·7	Saline.
52	,, Tea-tree Spring	170	13·4	Alkaline, siliceous.
53	,, Source No. 1	160	10·8	Alkaline.
54	,, Source No. 2	166	13·0	,,
55	,, Waipahihi Stream ..	98	8·6	Saline.
56	Left bank, Waikato, Waiariki ..	125	10·8	Chlorinated saline.
	Waikato District.			
57	Whangape	160–200	6·0	Alkaline.
	Ruapehu District.			
58	Onetapu, Waikato	70	58·0	.. ..

No.	Name and Locality.	Temp. Fahr.	Grains per Pint.	Chemical Character of Water.
	East Cape District.	Deg.		
59	Roparoa, Waiapu	Cold	..	Saline, bituminous.
60	Manutahi ,, ...	,,	..	,,
61	Pepoti ,, ...	,,	..	Hydrocarbon gas.
62	Waipaoa, Poverty Bay	,,	..	Bituminous.
63	Waipiro, Waiapu	144	..	Calcareous, bituminous.
	Wellington District.			
64	Wallingford	60	10·4	Acid.
65	Pahua	Cold	184·2	Alkaline.
66	Burton's Spring	,,	..	..
67	Akiteo (*a*)	,,	62·4	Alkaline.
68	,, (*b*)	,,	4·8	Sulphurous.
	South Island.			
69	Hanmer Plain Springs, Amuri ..	90–104	10·8	Alkaline.
70	Sumner Lake Springs ,, ..	93	2·3	Saline.
71	Amberley Spring, Canterbury ..	Cold	11·7	Chalybeate.
72	Wickliffe Bay Spring, Otago	..	34·6	Saline.
73	Gibson's Spring, Southland	Cold	2·3	Alkaline.

1. *Ohaeawai,* Auckland. A group of springs used as baths, 17 miles from Bay of Islands, the waters of which are acidic, depositing sulphur and alum on cooling. Silica is only deposited as a granular sediment. These springs are chiefly interesting from their being accompanied by an escape of mercurial vapour, which deposits cinnabar and metallic mercury. Their medicinal action is tonic and chalybeate, and they have a specific alterative action in skin diseases.

2. *Waiwera,* on the coast, 30 miles north of Auckland. A powerful escape of weakly alkaline and saline water, extensively used as baths for rheumatic and dyspeptic complaints; used internally it has also a mild antilithic action. This spring is largely resorted to, and most comfortable accommodation is provided for visitors.

ANALYSIS.	Grains per Gallon.
Chloride of sodium	116·715
,, potassium	·091
,, lithium	traces
Iodide of magnesium	traces
Sulphate of soda	·383
Bicarbonate of soda	87·513
,, lime	10·692
,, magnesia	·954
,, iron	·683
Alumina	traces
Silica	2·464
	219·495

3. *Puriri,* about ten miles from Grahamstown. A cold, effervescent water, having valuable properties from the presence of a large percentage of alkaline carbonates. It is bottled both as still and aërated water, and is coming into repute as an antilithic aperient, and would probably be useful in cases of acid dyspepsia and in disorders of the kidney and bladder. In chemical properties it approaches very closely to Fachingen and Ems waters of Nassau in Germany.

	Grains per Gallon.
Chloride of sodium	21·938
Iodide of magnesium	traces
Sulphate of soda	·940
„ potash	4·938
Carbonate of iron	traces
Bicarbonate of lime	28·506
„ magnesia	25·625
„ soda	452·393
„ lithia	traces
Silica	2·772
Phosphoric acid	not determined
	537·112

4–5. *White Island.* A conical island in the Bay of Plenty, formed by the summit of an extinct volcanic mountain rising out of deep water. The crater is occupied by a lake of strong mineral water, which is fed by intermittent geysers and boiling springs which surround it. All these waters are intensely acid, and deposit sulphate of lime; while the accompanying vapours form irregular deposits of pure sulphur. The first water is too powerful to be used medicinally in its natural state, but might be turned to valuable account in certain chemical manufactures.

6–34. Are associated geographically as all coming from the famous Rotorua and Rotomahana Districts. They, however, present considerable variety in quality, and may be classed as follows:—

6–17. *Alkaline and Siliceous Waters.*—These differ from the ordinary alkaline waters in the presence of silicic instead of carbonic acid as the combining agent. They are remarkable from their building extensive mounds and terraces composed of silica deposited by the cooling water, and involving as it solidifies a certain amount of granular silica, which is held in mechanical suspension; in this manner the wonderful pink and white terraces of Rotomahana and

the domes of Whakarewarewa have been formed. This class of water invariably contains carbonic-acid gas, and in some cases also sulphuretted hydrogen in large quantity, the oxidation of which leads to the formation of sulphurous and sulphuric acid and the liberation of hydrochloric acid, and in this way gives rise to the acidic waters. When used as baths they have an undoubted alterative action, and are very useful in rheumatic affections, especially in gouty constitutions. This is probably due to the specific action of silicates in promoting the discharge of uric acid from the system, as has lately been pointed out by French chemists.

Acidic Waters. In the case of these waters the carbonates have been wholly eliminated, and the alkaline salts are formed by a mineral acid, either sulphuric or hydrochloric. In some cases the acid is greatly in excess, forming a bath which has a powerful action upon the liver and upon diseases dependent on the derangement of that important organ. In some the presence of sulphurous and hydrosulphuric acid in large quantities gives these baths great efficacy in cutaneous diseases.

The following are the analyses of four types of the mineral waters in the Rotorua District :—

32. "Te Pupunitanga," commonly known as the "Priest's Bath;" aluminous and strongly acid (reaction acid).

	Grains per Gallon.
Sulphate of soda	19·24
,, potash	traces
,, lime	7·41
,, magnesia	3·03
,, alumina	21·67
,, iron	1·24
Sulphuric acid	22·12
Hydrochloric acid	3·65
Silica	18·41
	96·77
Sulphuretted hydrogen	2·98
Carbonic-acid gas	2·16

29. "Whangapipiro," commonly known as "Madame Rachel's Bath;" saline waters with silicates (reaction alkaline).

	Grains per Gallon.
Chloride of sodium	69·43
„ potassium	3·41
„ lithium	traces
Sulphate of soda	11·80
Silicate of soda	18·21
„ lime	4·24
„ magnesia	1·09
Iron and alumina oxides	2·41
Silica	5·87
	116·46
Carbonic-acid gas	3·79

24. "Te Kauwhanga" (*a*), commonly known as "Cameron's Bath;" hepatic, feebly saline, with excess of acid (reaction acid).

	Grains per Gallon.
Sulphate of soda	44·54
Chloride of potassium	1·67
„ sodium	12·04
„ calcium	5·22
„ magnesia	1·28
„ alumina	0·62
Silica	9·22
Hydrochloric acid	5·92
	80·51
Sulphuretted hydrogen	4·42
Carbonic-acid gas	1·96

8. "Turikore." Faintly acid reaction, which turns to alkaline on boiling.

	Grains per Gallon.
Silicate of soda	16·32
„ lime	1·61
„ magnesia	1·14
„ iron	·39
Sulphate of soda	13·47
Chloride of potassium	1·24
„ sodium	53·61
Phosphate of alumina	traces
	87·78

An interesting paper, communicated to the *Australasian Medical Gazette* by Dr. Hope Lewis, and a pamphlet by Dr. A. Ginders,* the medical officer in charge, give full particulars of the medicinal advantages of the many springs.

35–56. With the exception of the first two their general characters are saline and faintly acid. They are reported to be suitable for internal and external use, as alteratives, in scorbutic and tubercular diseases, also in chronic nervous affections and cutaneous eruptions. The presence of iodine in these waters, which was formerly reported, has been disproved by recent analyses of authentic samples.

57. Whangape, Waikato, is a hot alkaline water, having a composition similar to those of Puriri and Waiwera.

58. Onetapu Desert, at the sources of the Waikato and Wangaehu Rivers. This powerful spring, which issues at the base of Ruapehu, is so strongly charged with sulphates of iron and alumina as to taint the water of the latter river from its source to the sea, a distance of seventy miles. It is only one of the many mineral springs which occur in the still active volcanic district of Tongariro.

59–62. In the East Cape and Poverty Bay District are four—out of some seventeen different springs which have been discovered—that yield hydrocarbons, either in the form of gas or oil, and associated with saline waters. The source of these springs is probably certain bituminous shales at the base of the Cretaceous formation.

63. Waipiro is interesting as being a hot spring in the same district (in which there is no evidence of any volcanic action), and as depositing immense quantities of carbonate of lime in acicular crystals. This lime-deposit is built up in the form of a wall, marking the line of fissure through which the water escapes.

64–65. Are cold springs in the Wellington District, and belong to the class of saline waters, which are generally feebly acid. Springing from rocks of Lower Secondary formation, they are interesting from the large proportion of iodine and other exceptional elements which they contain. Pahua is the most notable in this respect, and has the following composition :—

* "The Thermal-Springs, Rotorua, New Zealand: Hints on cases likely to benefit by treatment thereat." Wellington. By authority: George Didsbury, Government Printer.

	Grains per Gallon.
Chloride of sodium	1,303·329
„ potassium	·501
„ magnesium	34·960
„ calcium	120·885
Iodine of magnesium	·582
Bromide of magnesium	traces
Sulphate of lime	3·026
Phosphate of alumina	·641
„ iron...	traces
„ lime	·430
Bicarbonate of lime	6·451
Silica	1·696
Iodine, free	1·595
	1,474·096

Total quantity of iodine to the gallon (free and combined), 2·127 grains.

66. Burton's Taipo, in addition to iodine, contains traces of arsenic.

67, 68. Akiteo (*a*) is a strong saline water containing iodides and bromides, while Akiteo (*b*) is an aërated chalybeate water, and would be valuable as a tonic, being similar to the springs at Pyrmont, Waldeck, and Recoaro, Venetia. Aërated chalybeate waters of medicinal value are found in many other parts of New Zealand; among these may be mentioned a locality near Whangarei, in the North, and Chain Hills, near Dunedin, in the South.

69. The springs which occur at the Hanmer Plains, Amuri, are alkaline, with a strong escape of sulphuretted hydrogen, and would form useful baths in rheumatic and cutaneous diseases.

70. At the distance of a few miles from Sumner Lake water has a temperature of 93° Fahr., as it gushes from the sandstone rock, but it does not contain sufficient matters in solution to entitle it to rank as a mineral water.

71. Amberley. This was analysed and reported on by Professor Bickerton, of the Canterbury College, as a chalybeate water, but unfit for use on account of the organic matter present. The analysis gave the following quantitative results:—

	Grains per Gallon.
Total dissolved solids	37·6
Volatile	8·8
Fixed	28·8
Carbonate of lime	3·6
Carbonate of magnesia	2·2
Chlorine	10·5
Iron protoxide	2·3
Free ammonia	·069
Albuminoid ammonia...	·034
Sediment	165·2

72. Wickliffe Bay, Otago. An analysis of this water is given by Professor Black, of Otago University. It appears to be a saline water :—

	Grains per Gallon.
Sulphuric acid (combined)	39·3
Cholorine	112·0
Magnesia	18·3
Lime	11·5
Alkalies	83·0
Carbonic acid (combined)	12·6

73. Gibson's Spring, Southland, is a water which is stated to be a specific in diarrhœa, and contains a large amount of organic matter, to some astringent quality of which its medicinal qualities are probably due.

STATISTICAL DIAGRAMS.

With the view of presenting a ready means for observing the rate of economic progress of New Zealand, some of the leading statistical features have been collected and thrown into graphic form—a method of representation which has the double advantage of appealing to the understanding by means of an expression of form as well as of figures, and is especially applicable to purposes such as the present.

The period shown is that from 1868 to 1884, and the diagrams will afford opportunity for much interesting comparison, illustrative of the more or less rapid advances in material prosperity.

The diagrams treat of the following subjects :—

No. I. Population.—This shows the birth-rate and death-rate per 1,000, and the ratio of increase per 100 in the population of New Zealand. The great leap made by New Zealand in 1874 was due to the fact of the Immigration and Public Works Act having that year

come into active operation, under the provision of which an extraordinarily large number of immigrants were brought out by the Government. The somewhat low position shown in 1878 and 1881 is accounted for by the circumstance of an error having accumulated in the estimated yearly returns of population between the periodic census of 1874 and 1878 and 1881, which necessarily lowers the apparent rate of increase for these years.

No. II. MARRIAGES.—The marriage-rate per thousand of population has fluctuated considerably. This fluctuation is also a peculiarity of the Australian Colonies, with the exception of Victoria.

No. III. TOTAL TRADE: IMPORTS AND EXPORTS (produce of the colony).—New Zealand has not maintained the position held at the commencement of the period under notice.

No. IV. SAVINGS.—In this diagram, which exhibits the rate of deposits in Post-Office and other Savings Banks to population, the colony, it is shown, has made considerable progress.

No. V. RAILWAYS.—The proportion of constructed railways to population is shown in this diagram.

No. VI. TELEGRAPHS.—This diagram is similar to the above.

No. VII. WHEAT.—The average yield of wheat per acre, shown in this diagram, contrasts favourably with the general average given of America, which is about 11½ bushels per acre.

No. VIII. CULTIVATION.—This diagram exhibits the area of land in cultivation (including land under sown grasses) in proportion to the population. The extraordinary progress made by New Zealand in this direction is very strikingly shown.

No. IX. GOLD.—The value of gold raised in proportion to population during the years 1868–84 is shown in this diagram. The decline in the quantity of gold raised in New Zealand is very marked.

No. X. RELATIVE INCREASE OF POPULATION AND PUBLIC DEBT.—For the purpose of comparison the increase of population since 1868 (from 220,000 to 570,000), and that of the public debt (from £7,000,000 to £30,000,000), have each been divided into twenty equal parts.

By Authority: GEORGE DIDSBURY, Government Printer, Wellington.—1886.

	ate	Percentage of Forest Land.
North Island		
South Island		
Stewart Island		
Total	and.	
Total estimated	50	9·449
Maoris), 30th S	00	11·803
Population as per	00	83·013
Composed of the		...
English and W	00	57·142
Scotch ...		...
Irish ...		
Australian		
New Zealand	00	14·434
Other British	00	19·301
Foreign	50	4·306
Uncertain	00	62·809
Chinese	00	8·729
Maori Popula		...
Marriage-rate		
Birth-rate ...		...
Death-rate ...		

Population of pri[illegible]

Auckland and	
Wellington	
Christchurch	
Dunedin	

CENNIAL TABLE.

	uri Gum.	Timber.
	£	£
	138,523	40,046
IMMIGRAT	109,234	49,847
	118,348	50,901
1876	132,975	39,074
1877	147,535	35,735
1878	242,817	51,225
1879	253,778	71,328
1880	260,369	114,700
1891	336,606	151,411
1882	342,151	152,471
1883		
1884	creased manufacture	
1885	European markets.	

	nds.	Capital.
Total Shipping (1		
Inwards ...		£
Outwards ...	781	229,000
Registered Vesse	284	...
Imports and Exp	450	357,000
Total value o	228	67,000
Value of Gold	526	317,000
,, Woo	468	97,000
,, Agri	859	123,000
G	238	773,628
B	992	229,000
	685	105,000
Tallow	147	...
Frozen meat		

	er of ers.	Value.
Gold returns fro		
Auckland		£
Marlborough		
Nelson	04	9,591,749
West Coast	59	4,041,165
Otago	67	8,829,845
Wellington	04	18,916,787
Canterbury	17	24,811,534
	7	2,582,273
	58	68,773,353
Total length of	64	1,841,592
tober, 1885	73	205,790
Total under cons	71	308,184
Expended in co	94	363,398
31st March, 1	56	1,065,640
Railway working	19	199,626
31st March, 1		
Railway worki	77	39,842,230
ending 31st M		

DISTANCES BY SEA.

		Miles.
East Coast.—Auckland to Bay of Islands	...	160
,, ,, ,, Tauranga	...	130
,, ,, ,, Poverty Bay	...	300
,, ,, ,, Napier ...	...	390
,, ,, ,, Wellington	...	590
,, Wellington to Lyttelton	...	174
,, Lyttelton to Port Chalmers	...	190
,, Port Chalmers to Bluff Harbour		113
West Coast.—Manukau Harbour to New Plymouth	...	133
,, New Plymouth to Wanganui	...	100
,, ,, ,, Nelson	...	147
,, Nelson to Westport ...	...	165
,, Westport to Greymouth	...	47
,, Greymouth to Hokitika	...	25
,, Wellington to Wanganui	...	98
,, ,, New Plymouth	...	198
,, ,, Picton ...	...	52
,, ,, Nelson ...	...	92

Auckland to Melbourne	...	...	...	1,650
,, Sydney ...	...	...	...	1,315
Onehunga to Sydney...	...	...	...	1,180
Wellington to Melbourne	...	...	...	1,400
,, Sydney	...	...	...	1,200
Lyttelton to Melbourne	...	...	...	1,300
Port Chalmers to Melbourne		...	...	1,160
Bluff Harbour to Melbourne...		...	...	987

DISTANCES BY RAILWAY.

North Island.

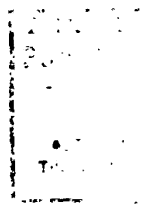
		Miles.
Auckland to Drury ...	... ...	22
,, Mercer ...	... ...	43
,, Te Awamutu	... ...	106
,, Onehunga	... ...	8
,, Helensville	... ...	38
Whangarei to Kamo ...	... ...	7
Napier to Tahoraite...	... ...	61
Wellington to Upper Hutt	... ...	20
,, Featherston	... ...	50
,, Masterton	... ...	71
,, Pukerua	... ...	24
Wanganui to Feilding	... ...	51
,, Foxton	... ...	86
,, Waverley	... ...	33
New Plymouth to Waitara	... ...	10
,, Hawera	... ...	48
,, Foxton	... ...	171

South Island.—Main Line.

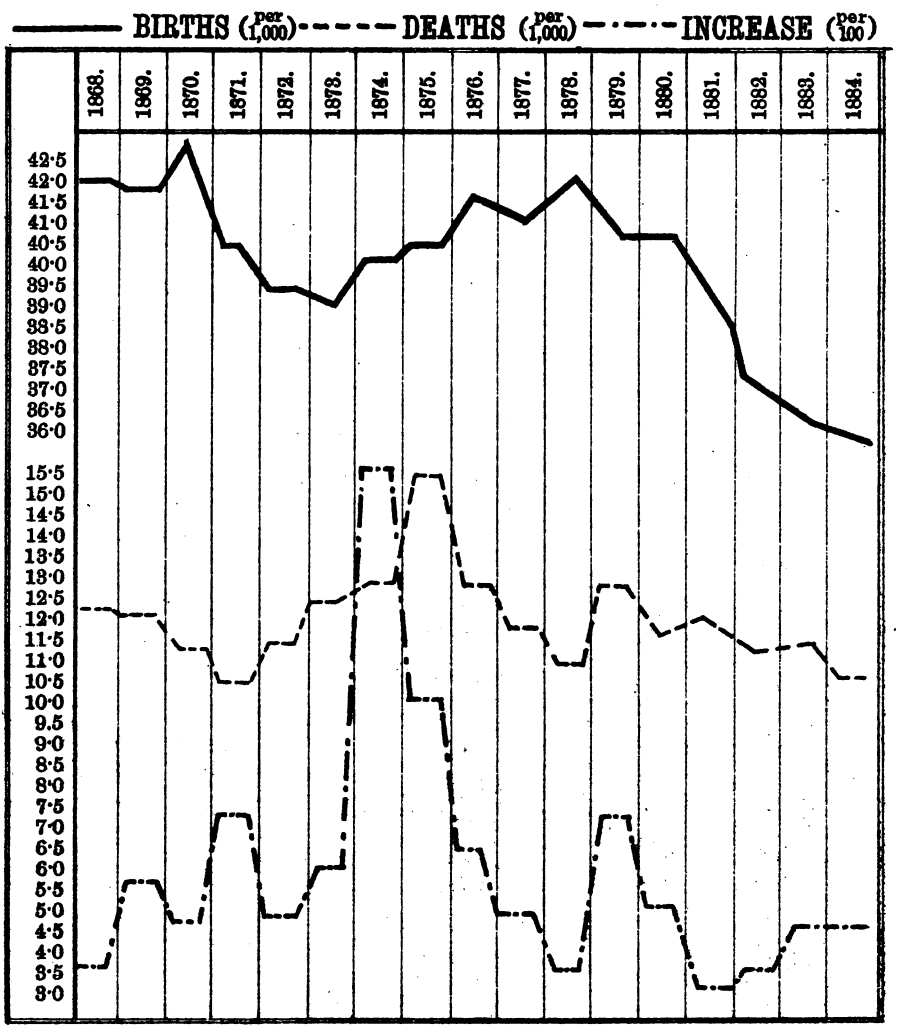
Christchurch to	Miles.		Miles.
Rolleston Junct.	15	Port Chalmers...	223
Rakaia ...	36	Dunedin ...	230
Ashburton ...	53	Milton ...	265
Timaru ...	100	Balclutha ...	282
Oamaru ...	152	Gore	329
Palmerston ...	189	Invercargill ...	369

Branch Lines.

				Miles.
Nelson to Belgrove ...	...	...	...	22
Greymouth to Brunner	...	...	...	8
Westport to Wellington Coal-mine ...			...	12
Picton to Blenheim ...	...	...	...	18
Christchurch to Amberley and Waikari			...	50
,, White Cliffs		...	...	42
,, Springfield ...		...	...	46
,, Oxford ...		...	...	42
,, Lyttelton ...		...	...	7
,, Southbridge		...	...	32
Rakaia to Ashburton Forks ...		...	...	23
Studholme to Waimate		...	...	5
Ashburton to Anama	...	...	...	...
Christchurch to Birdling's Flat		...	...	33
Timaru to Albury ...	...	...	...	25
Oamaru to Duntroon and Kurow		...	...	41
,, Ngapara ...	...	...	...	17
Dunedin to Outram ...		...	...	19
,, Lawrence		...	...	60
,, Port Chalmers		...	...	9
,, Kingston...		...	...	163
Stirling to Kaitangata		...	...	5
Otautau to Nightcaps		...	...	37
Invercargill to Kingston		...	...	87
,, Bluff ...		...	...	17
,, Kelso...		...	...	59

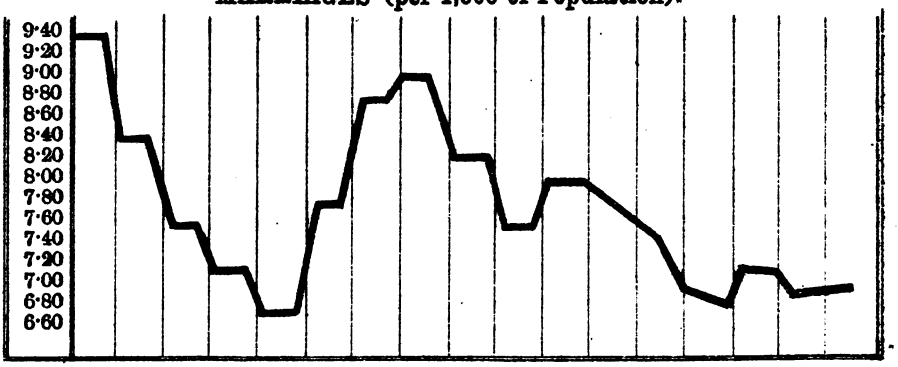


No. I.



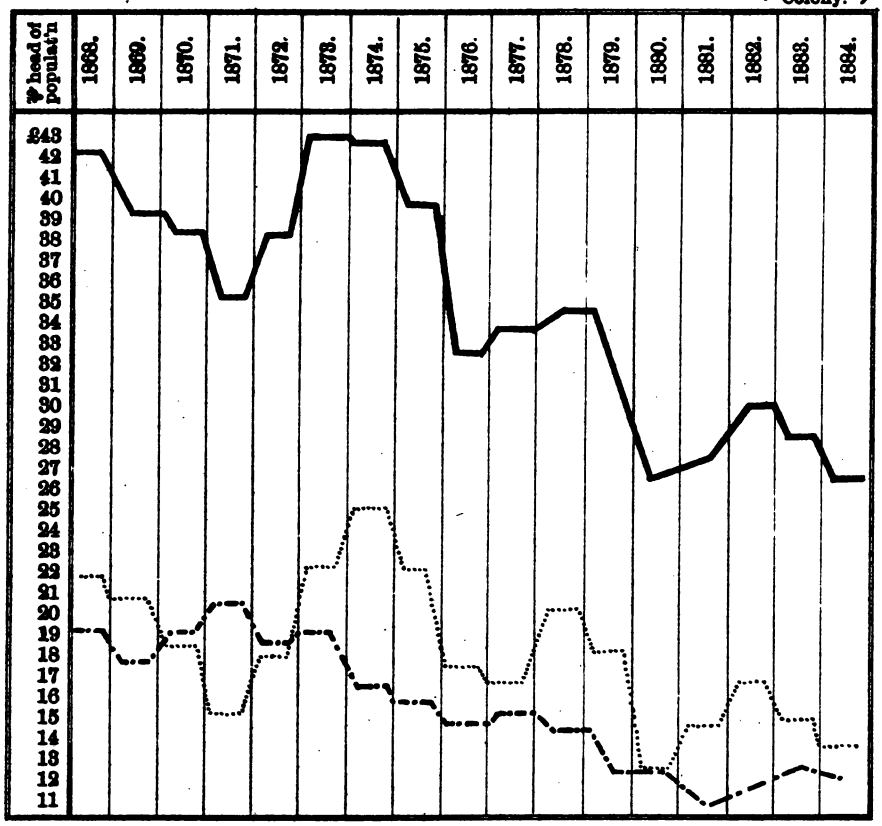
No. II.

MARRIAGES (per 1,000 of Population).

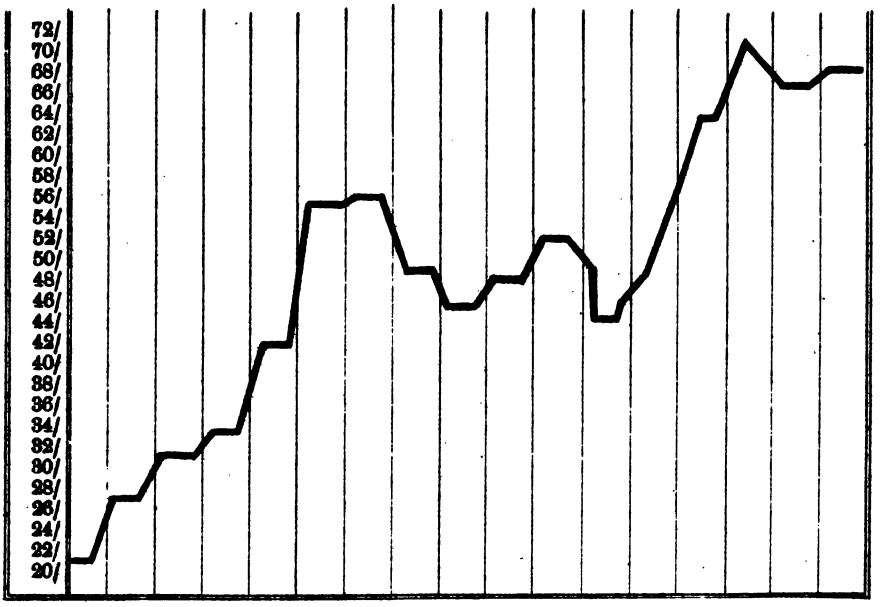


No. III.

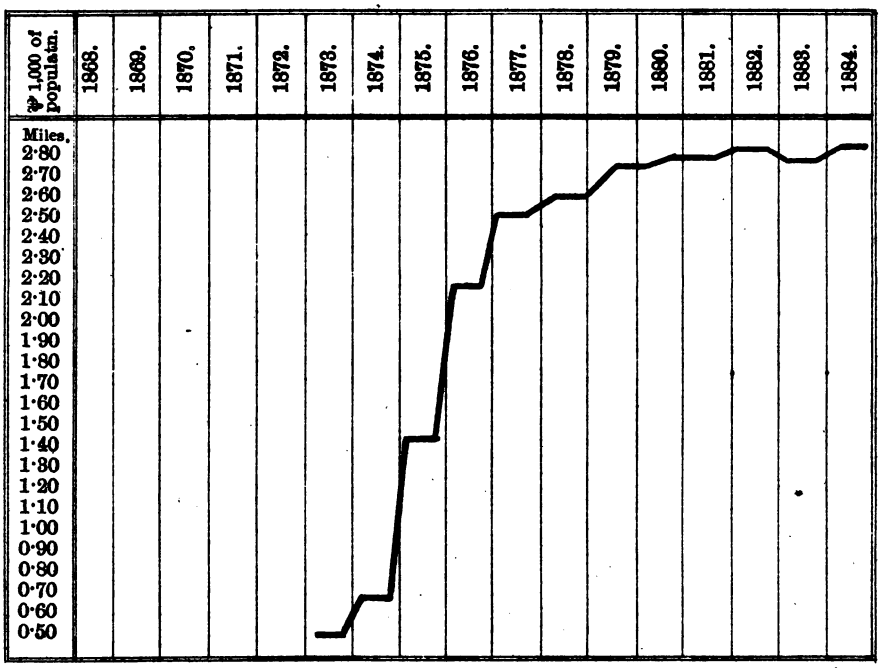
TOTAL TRADE. ..... IMPORTS. - - - - - EXPORTS (Produce of Colony.)



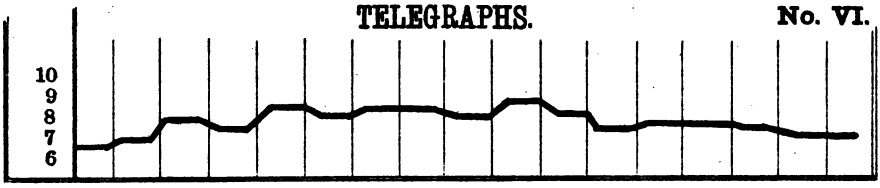
DEPOSITS IN SAVINGS BANKS. No. IV.



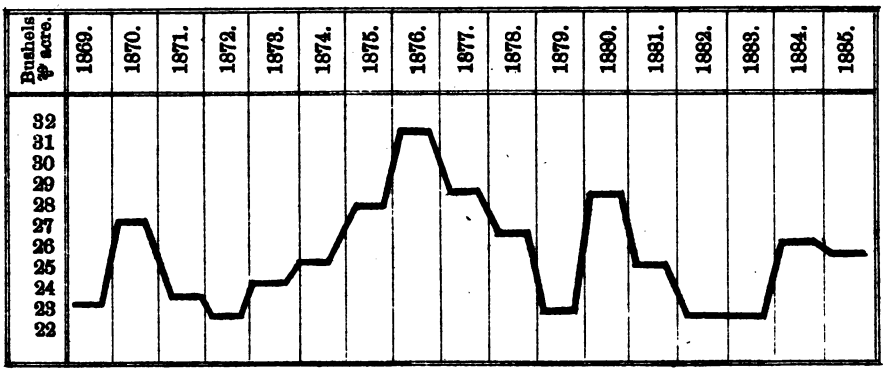
RAILWAYS. No. V.

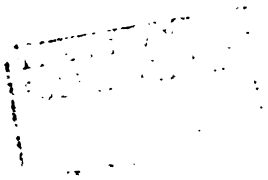


TELEGRAPHS. No. VI.

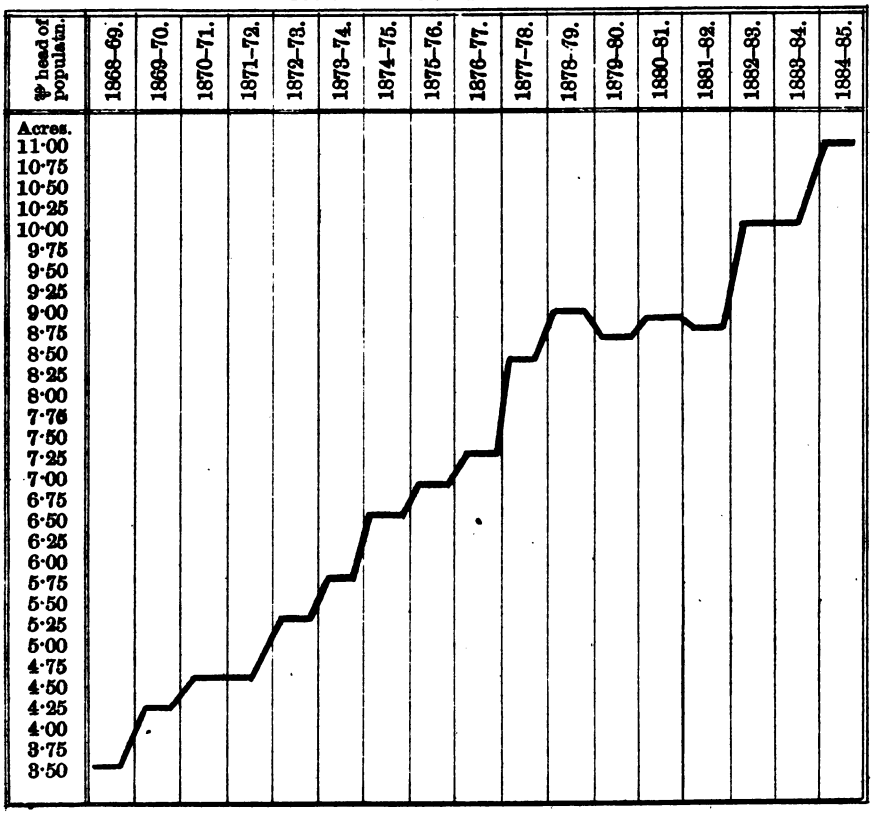


AVERAGE YIELD OF WHEAT. No. VII.

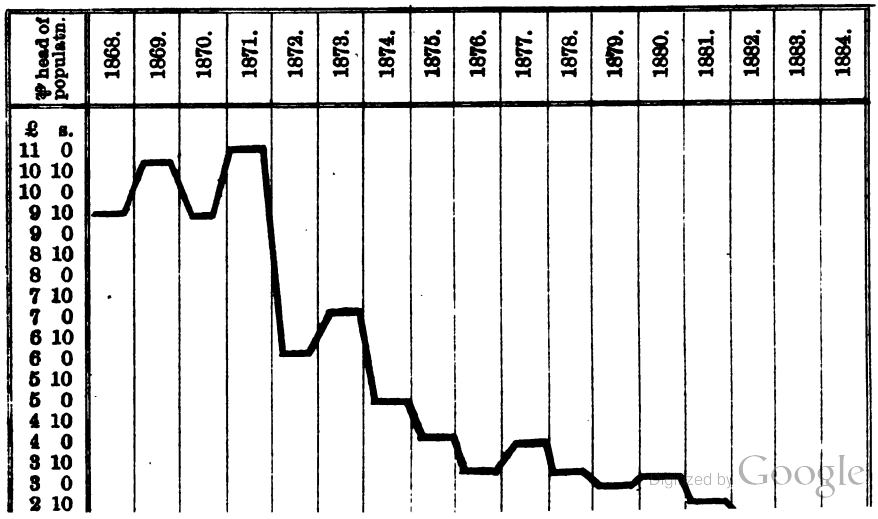




LAND IN CULTIVATION. No. VIII.



GOLD RAISED. No. IX.

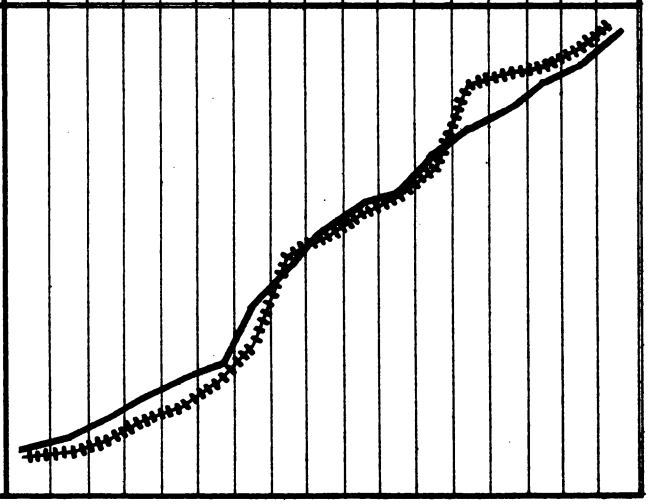


No. X.

RELATIVE INCREASE OF POPULATION AND PUBLIC DEBT.

POPULATION. DEBT.

Population.*	Public Debt.*
570,000	30,000,000
552,500	28,850,000
535,000	27,700,000
517,500	26,550,000
500,000	25,400,000
482,500	24,250,000
465,000	23,100,000
447,500	21,950,000
430,000	20,800,000
412,500	19,650,000
395,000	18,500,000
377,500	17,350,000
360,000	16,200,000
342,500	15,050,000
325,000	13,900,000
307,500	12,750,000
290,000	11,600,000
272,500	10,450,000
255,000	9,300,000
237,500	8,150,000
220,000	7,000,000



* The increase since 1868 of each divided into 20 equal parts.

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W. Wanganui

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171°